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THE
MAMMOTH
Cyclopædia.

Volume I.

The Leisure Hour Library.

PUBLISHED WEEKLY BY

F. M. LUPTON, 63 MURRAY STREET, NEW YORK.

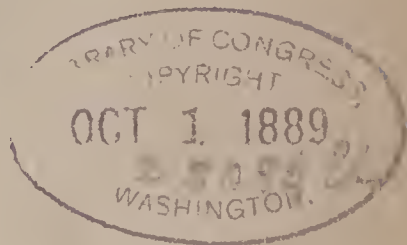
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THE
MAMMOTH
CYCLOPÆDIA.

VOLUME I,

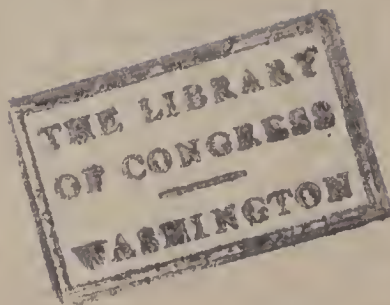


EMBRACING

*HISTORY, BIOGRAPHY, NATURAL HISTORY, TRAVELS,
MANNERS AND CUSTOMS, MANUFACTURES, VEG-
ETATION, INVENTION AND DISCOVERY, MIN-
ING, THE SEA, FAMILIAR SCIENCE, LAW,
STATISTICS, Etc., Etc.*

WITH TWO HUNDRED AND SEVENTY-THREE ILLUSTRATIONS.

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PREFACE.

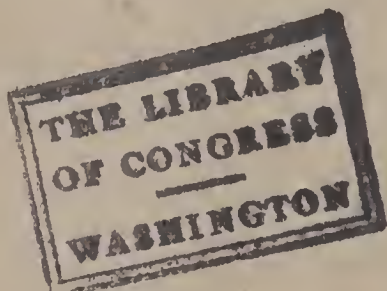
A RICH store of knowledge may be obtained from books—in fact therein may be found all, or nearly all, that mankind has yet discovered; but there are two entirely opposite methods of giving knowledge to the world. The first is that which enters into extensive detail, and repels and confuses the average reader with scientific phraseology and verbose description. The second is that which seeks, by simplicity and conciseness, to make knowledge attractive, entertaining and amusing its readers while it instructs and benefits them. The latter is the method adopted in the present volume.

The object is to present for family reading a book which will interest and entertain the most careless reader and at the same time fill his mind with knowledge of the most useful character—a book which may be taken up at random, as in idle moments, and read with interest and profit by all classes and conditions of mankind. Few men or women are so well informed that they will not learn much that is of real interest and value to them from this book. Herein is information for the curious, knowledge and facts for those who seek them, self education for old and young.

The material of a dozen ordinary volumes has been carefully epitomized and combined in one, yet, unlike other Cyclopædias sold at low prices, which are practically nothing more than defining dictionaries, it undertakes to treat upon only such a number of topics as can be treated satisfactorily and well. First, we have the department of "Biography," containing sketches of the lives of half-a-hundred of the most prominent men who have figured in the history of this country and Europe for a century or more past, each biography being accompanied by a portrait. In the department of "History" are given graphic descriptions of several of the most important historical occurrences of the present and former times. Under "Natural History" will be found exceedingly interesting descriptions of animals, birds, reptiles, fishes and insects, nearly all of which are accompanied by handsome illustrations. In the department of "Travels, Manners and Customs, Etc.," are given descriptions of the life of people of many countries and climes, their peculiar rites, forms and ceremonies. Under "The World Illustrated" are described some of the most wonderful works both of the Creator and of man. "Useful Arts and Manufactures" describes various industrial processes, and will be found exceedingly interesting and profitable reading. Under "Trees, Plants, Fruits, Etc.," are given descriptions of the vegetable productions of foreign countries, acquainting the reader with many interesting and useful facts regarding these things. "Great Inventions" describes the history of some of the most important mechanical discoveries of mankind, and "Mining" relates to the production of the mineral wealth of the earth. "Wonders of the Sea" treats of the wonderful and beautiful things found upon the floor of the ocean. "Familiar Science" describes the earth and other members of the solar system, likewise the various agents, forces, etc., in nature. "Law for the Masses" will be found of great benefit to men and women in the practical

relations of life, while the department of "Statistical and Miscellaneous" is a repository of useful and interesting facts and figures. The illustrations, of which there are two hundred and seventy-three, form one of the most desirable features of the book, and greatly enhance its interest and value.

The work is submitted in the hope that it may find a warm welcome in thousands of American homes, and in the firm conviction that its patrons will be invariably its friends and admirers. It is not too much to say that never before in the history of book-making has a work containing so vast an amount of useful information been presented in so attractive a form and given to the public at so low a price. It is a book for the masses—for old and young, rich and poor. It may be read continuously, or, by the aid of the index at the end, used as a work of reference. A glance over its pages will serve to convey an idea of the extent and variety of its contents, yet the real excellence and value of the work cannot be appreciated until it has been read from beginning to end.



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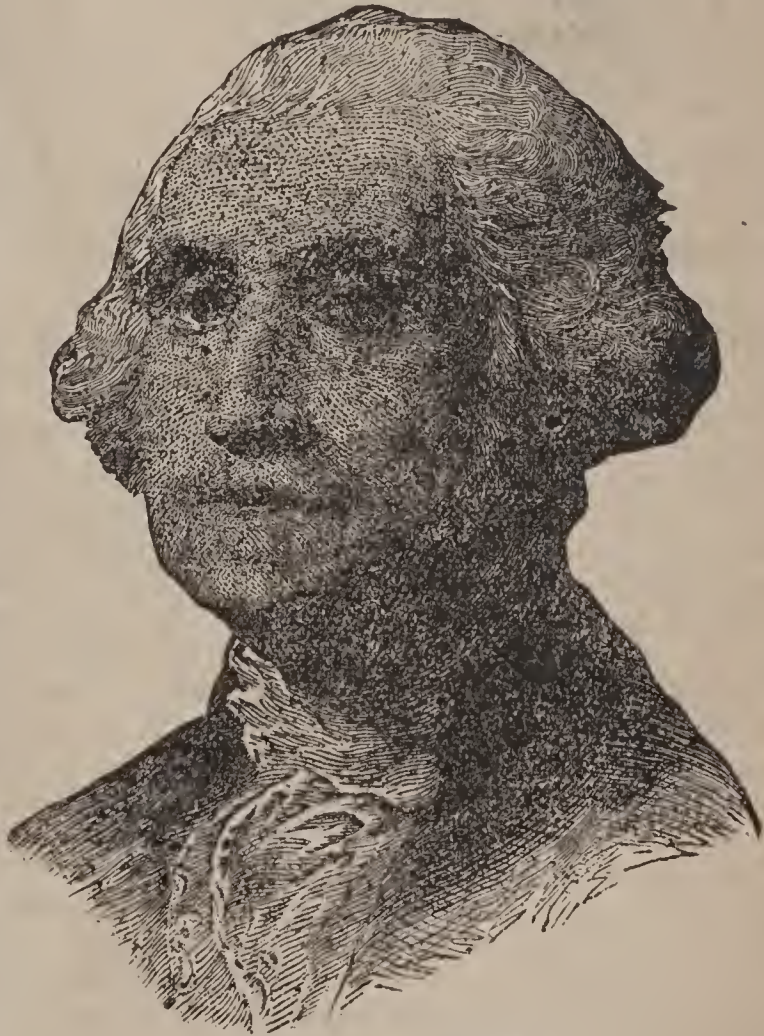
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BIOGRAPHY.

George Washington.—George Washington was born in Westmoreland County, Virginia, February 22, 1732, and was the son of Augustine Washington, who died in 1744. His early life was spent chiefly with his brother at Mount Vernon, and with Lord Fairfax, who owned great estates in the Virginia valley; and in 1748 he engaged to survey these wild territories for a doubloon a day, camping out for months in the forest, in peril from Indians and squatters. At the age of 19, at the beginning of the Seven Years' War, he was appointed Adjutant of the provincial troops, with the rank of Major; in 1751, he made his only sea voyage—a trip to Barbadoes—with his brother Lawrence, who died soon after, and left George heir to his estates at Mount Vernon. At 22 (1754), he commanded a regiment against the French, who had established themselves at Fort Duquesne (now Pittsburgh), and held Fort Necessity against superior numbers, until compelled to capitulate. The year following, when two regiments of regulars were led against Fort Duquesne by General Braddock, Washington volunteered; and at the disastrous ambush of July 9, 1755, he was the only aide not killed or wounded. He had four bullets through his coat, and two horses were shot under him. In 1759, he married Mrs. Martha Custis, a wealthy widow. He was, like nearly all Americans of property at that period, a slaveholder, and possessed at his death 124 slaves, whom he directed, in his will, to be emancipated at the death of his wife (who sur-



GEORGE WASHINGTON.

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vived him but three years), so that the negroes of the two estates, who had intermarried, might not be separated. He was for some years a member of the Virginia Assembly; and in 1774, he was ready to fight for the constitutional rights of the colonists. The news of the battle of Lexington (April 19, 1775) called the country to arms; and Washington, then a member of the Continental Congress, was elected Commander-in-Chief by that body. He hastened to the camp at Cambridge; compelled the evacuation of Boston; was driven from New York; compelled to retreat across New Jersey; often defeated, and reduced to the most desperate straits, by disaffection, lack of men and supplies, and even cabals against his authority; but by his calm courage, prudence, firmness and perseverance, he brought the war, with the aid of powerful allies, to a successful termination; and (December 23, 1783), the independence of the thirteen colonies achieved, he retired from the army to Mount Vernon. He refused pay, but kept a minute account of his personal expenses, which were reimbursed by Congress. The Federation of States having failed to give an efficient government, Washington proposed conventions for commercial purposes, which led to the convention of 1787, of which he was a member, which formed the present Federal constitution, considered by him as the only alternative to anarchy and civil war. Under this constitution he was chosen President, and inaugurated at New York, April 30, 1789. He served two terms, and died December 14, 1799.

John Milton.—This English poet was born in London, December 9, 1608. His father was of an ancient Catholic family, but was disinherited on becoming a Protestant. By occupation he was a scrivener, and a person of great musical accomplishments, being the composer, among other things, of two well-known psalm tunes—"Norfolk" and "York." From him the son derived his matchless ear and that strict integrity of character for which he was famous. Milton was carefully nurtured and educated, graduating in 1632 from Christ College, Cambridge, with the degree of A. M. He married Mary Powell, the daughter of an Oxfordshire royalist, by whom he had three daughters, Ann, Mary, and Deborah. The union was an unhappy one and a separation followed. The wife was fond of gay society, while the husband was of an austere, philosophic mind, and two such natures coming together the inevitable clashing at once ensued. A genuine and permanent reconciliation took place after a lapse of time, however. Death calling his first wife home, the poet married a second, but she lived only about two years, dying in childbirth. Unceasing study affected Milton's eyesight and he became totally blind, but this did not hinder his marrying a third time. "*Paradise Lost*," his greatest poem, was sold for £5, with the promise of another like amount from the publisher when sales had reached 1,300 copies. He died Sunday, November 8, 1674, and was buried in the chancel of St. Giles, Cripplegate, by his father's side. He left some £1,500 in property. Milton was stately and grand above all English poets. In one of his prose tracts he did not scruple to say that he proposed to write a poem which would be one of the glories of the century. His pledge was at last redeemed in old age, blindness and neglect.

Napoleon Bonaparte.—The celebrated warrior and Emperor of the French, Napoleon Bonaparte, was born at Ajaccio, in the island of Corsica, August 15, 1769. At the age of ten he entered the military school of Brienne, as a king's pensioner. In 1785 he obtained his commission as Sub-Lieutenant in the artillery regiment *de la Fere*. When the Revolution broke

out Napoleon took the popular side, but in a quiet and undemonstrative way. In December, 1793, he was sent by the convention to assist in the reduction of Toulon, with the rank of Lieutenant-Colonel of artillery. In the following February he was raised to the rank of Brigadier-General. In 1795 the convention was in great peril, on account of the mutinous spirit of the arrondissements of the capital, and Napoleon was made commander of the troops provided for its defence. On the 4th of October, 1795, the national guard, 30,000 strong, attempted to force its way into the Tuileries, where the convention was sitting, but was routed and dispersed by a terrible cannonade directed by the young artillery officer. Napoleon was immediately appointed to the command of the army of the interior. About this time he made the acquaintance of Josephine Beauharnais. Captivated by her elegant manners and amiable disposition, he proposed marriage to the graceful widow, and was accepted. The ceremony took place March 9, 1796. A few days before he had been appointed to the supreme command of the army of Italy, and he was forced to leave his bride almost at the altar. His famous campaigns against the Austrians for the conquest of Upper Italy, his invasion of Egypt, his phenomenal successes in the field, often against apparently insurmountable obstacles, are matters of history which volumes would be required to describe.

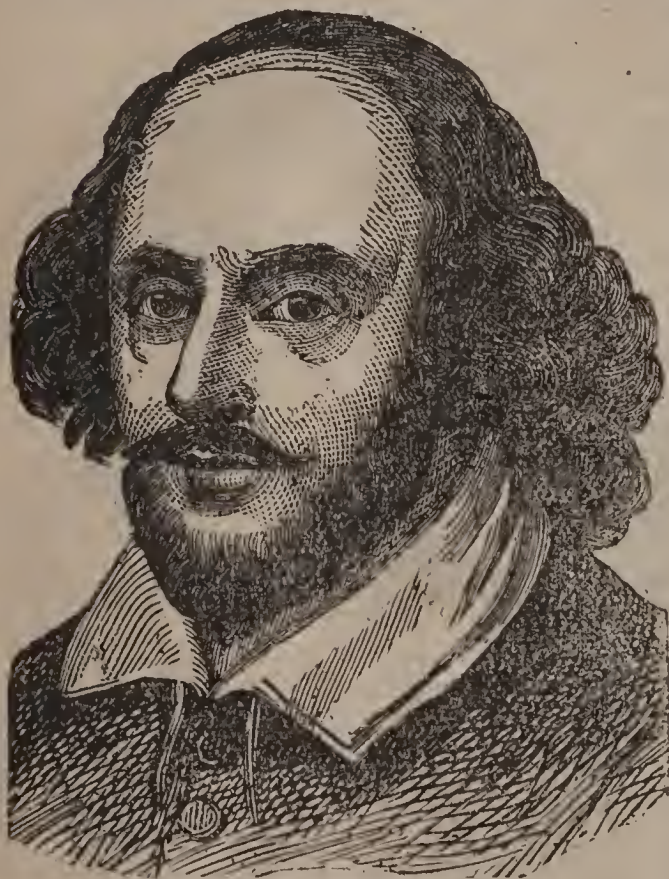


NAPOLEON BONAPARTE.

He overthrew the Directory in Paris and became ruler of France, being crowned Emperor in 1804, and in the same year was made King of Italy. He fought successfully against the allied forces of Russia and Austria at Austerlitz, annihilated the power of Prussia and captured Berlin, defeated Spain and seized the city of Madrid. His wife Josephine having borne him no children, being ambitious to perpetuate his power in his family, he proceeded to divorce her, and married Maria Louisa, Archduchess of Austria. Such is the outline of the history of the wonderful conquests of Napoleon, but soon disasters fell thick and fast. He invaded Russia with an army of half a million men. The Russians retreated, deliberately wasting the country and carrying off the supplies, but avoiding all engagements, the design being to surround Napoleon in the heart of the country, and, by the help of famine and the rigors of a northern winter, annihilate him. When he reached Moscow the city was deserted by its inhabitants, and a fire broke out which raged for three days and left the city a heap of ruins. When he began his

retreat his army was reduced to 120,000, and when he at last escaped from Russia he had not more than 25,000. Afterward, in his conflict with the allied powers of Prussia, Austria, and Russia, at Leipzig, and with the English and Prussians at Waterloo, he was completely annihilated, and lost his crown and liberty. He died an exile on the island of St. Helena, May 5, 1821.

William Shakespeare.—This famous man, who has been called “the chief literary glory of England,” was born at Stratford-on-Avon, April 23,



WILLIAM SHAKESPEARE.

1564. His father, John Shakespeare, was a yeoman, but his mother, Mary Arden, came of a good old Warwickshire family. William was the third child of a family of four sons and four daughters, and at the free grammar school of Stratford received his entire education. Misfortune overtook the father when the son was fourteen years of age, and in consequence William was withdrawn from school and set to work to earn his own livelihood. In what manner he was employed is unknown, but it is probable that he lived miscellaneously as he could. At the age of nineteen he was married to Anne Hathaway, of Shottery. Four children were born to them, two daughters and one son, the last mentioned dying in his twelfth year. Shakespeare went to London in 1586, and became identified in an

humble capacity with the Blackfriars Theatre, and very speedily we find him a man of some importance, at once dramatist, actor, and shareholder in the institution. As an actor he seems at no time to have shone especially, being rather respectable than eminent. As dramatist, his magnificent powers were at once recognized, and in no long time had won for him the very foremost rank among the writers for the stage of his time. He was a man of shrewd business ability, and his material prosperity kept pace with his poetical reputation. In addition to being a considerable shareholder in the Blackfriars Theatre he became part proprietor of the Globe, subsequently erected. To both he contributed dramas, and from his gains in the triple capacity of actor, author, and shareholder, he rapidly amassed a fortune. He purchased largely of landed property in his native town of Stratford, and in 1613 left London and established himself at the former place, where he occupied the closing days of his life in agricultural pursuits, but still continued to write for the stage. His death took place on his 53d birthday, April 23, 1616. The only works of Shakespeare certainly published under his own hand were the two poems “Venus and Adonis” and the “Rape of Lucrece,” which appeared in 1593—1594 respectively. As was naturally to be

looked for in the case of pieces on the stage so popular, certain of his dramas found their way from time to time into print, but no authoritative edition of any of them was issued during his lifetime. The first collected edition of his dramas was issued in 1623, by Heminge and Condell, his friends and co-proprietors in the Blackfriars and Globe theatres. A second edition followed in 1632; a third in 1664; and a fourth in 1685. In 1709, appeared the edition of Rowe, with a prefatory sketch of the poet's life. Of the "Shakespearean literature" which followed, and the various re-issues of the dramas, with such masses of critical commentary and emendation as no other writer has ever perhaps been made the subject of, it would be hopeless to attempt an account.

Lord Byron.—George Gordon, Lord Byron, was born in Holles Street, London, on the 22d of January, 1788. He was the only son of Captain John Byron, of the Guards, and Catherine Gordon, of Gight, an heiress in Aberdeenshire. Captain Byron and his wife did not live happily. The husband's habits were profligate in the highest degree, and the wife's fortune was soon squandered. Separated from her husband, the lady retired to the city of Aberdeen with her little lame boy, whom she passionately loved, her sole income at this time being about £130 per annum. In his 11th



LORD BYRON.

year, Byron succeeded his grand uncle, William Lord Byron; and mother and son immediately left the north for Newstead Abbey, the ancient seat of the family. On succeeding to the title, Byron was placed in a private school at Dulwich, and thereafter sent to Harrow. In 1805, he removed to Trinity College, Cambridge; and two years thereafter his first volume of verse, entitled "Hours of Idleness," was printed at Newark. The poems therein contained were not absolutely without merit, but they might have been written by any well-educated lad, who, in addition to ordinary ability, possessed the slightest touch of poetic sensibility. The volume was fiercely assailed by Lord (then Mr.) Brougham, in the *Edinburgh Review*, and his sarcasms stung Byron into a poet. The satire, "English Bards and Scotch Reviewers," was written in reply to the article in the *Edinburgh*, and the town was taken by a play of wit and a mastery of versification unequalled since the days of Pope. In 1812, he published the first two cantos of "Childe Harold," with immense success, and was at once enrolled among the great poets of his country. During the next two years, he produced "The

Giaour," "The Bride of Abydos," "The Corsair," and "Lara." He married Miss Milbanke, daughter of Sir Ralph Milbanke, a baronet in the County of Durham. This union proved singularly infelicitous. It lasted only a year, and during that brief period, money embarrassments, recriminations, and all the miseries incident to an ill-assorted marriage, were of frequent occurrence. After the birth of her child Ada, Lady Byron retired to her father's house, and refused to return. At Geneva, Byron produced the third canto of "Childe Harold" and "The Prisoner of Chillon." "Manfred" and "The Lament of Tasso" were written in 1817. The next year, he was at Venice, and finished "Childe Harold" there; and, in the

gay and witty "Beppo," made an experiment in the new field which he was afterwards to work so successfully. During the next three years, he produced the first five cantos of "Don Juan," and a number of dramas of various merit, "Cain" and "Werner" being opposite poles. In 1822, he removed to Pisa, and worked there at "Don Juan," which poem, with the exception of "The Vision of Judgment," occupied his pen almost up to the close of his life. He died at Missolonghi, in Greece, April 19, 1824. His body was conveyed to England; and, denied a resting-place in Westminster Abbey, it rests in the family vault in the village church of Hucknall, near Newstead.



WILLIAM PENN.

William Penn.—The celebrated English Quaker and philanthropist and founder of the colony of Pennsylvania.

William Penn, was the son of Sir William Penn, an eminent English admiral, and was born at London, October 14, 1644. He studied at Christ Church, Oxford, and while here was converted to Quakerism by Thomas Loe. His enthusiasm for his new faith was very great, and for non-conformity with the customs and services of the Church of England he was beaten and turned out of doors by his father, and, on one occasion, imprisoned in the Tower of London, and at another time in Newgate. His famous works, "No Cross, No Crown," "Innocency with her Open Face," and "The Great Cause of Liberty of Conscience" were written while in prison. In September, 1670, Admiral Penn died, leaving his son an estate of £1,500 a year, together with claims against the government for £16,000. He married, in the beginning of 1672, Gulielma Maria Springett, daughter of Sir William Springett, and for some years thereafter continued to propagate, by preaching and writing, the doctrines of his sect. Circumstances having turned his at-

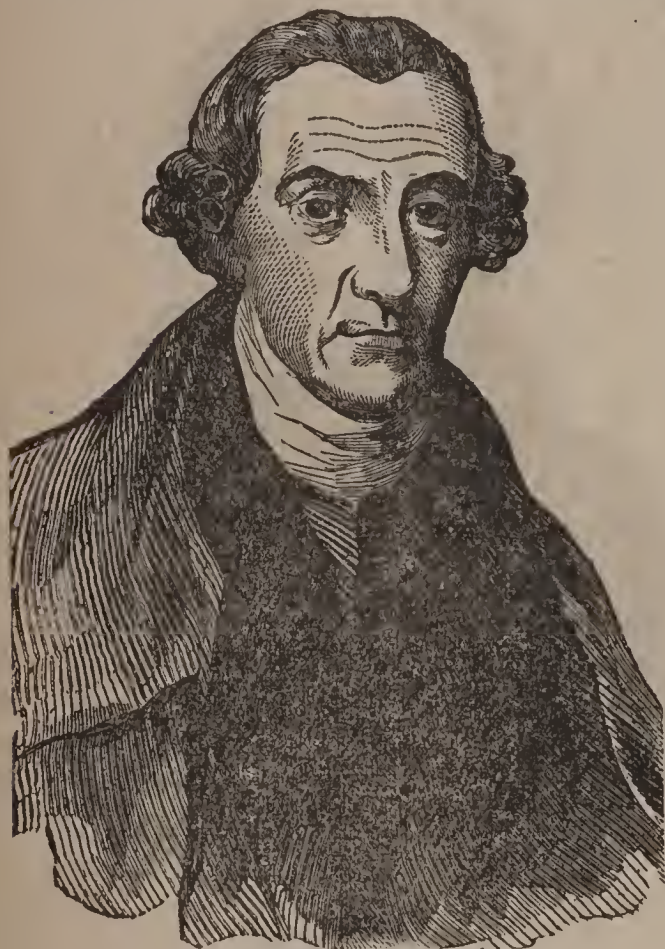
tention to the New World, he, in 1681, obtained from the crown, in lieu of his monetary claim upon it, a grant of the territory now forming the State of Pennsylvania. Penn wanted to call it Sylvania, on account of its forests; but the king (Charles II) good-humoredly insisted on the prefix Penn. His great desire was to establish a home for his co-religionists in the distant West, where they might preach and practice their convictions in peace. Penn, with several friends, sailed for the Delaware in August, 1682, was well received by the settlers, and on the 30th of November held his famous interview with the Indian tribes, under a large elm tree at Shackamaxon, now Kensington. He next planned and named the city of Philadelphia, and for two years governed the colony in the wisest, most benevolent and liberal manner. Not only Quakers, but persecuted members of other religious sects, sought refuge in his new colony, where, from the first, the principle of toleration was established by law. Having called the colonists together, he gave the infant state a constitution in twenty-four articles. Toward the end of the reign of Charles II, Penn returned to England to exert himself in favor of his persecuted brethren at home. His exertions in favor of the Quakers were so far successful, that in 1686 a proclamation was issued to release all persons imprisoned on account of their religious opinions, and more than 1,200 Quakers were set free. In 1693, his wife died, but in less than two years he married again. His second wife, Hannah Callowhill, was a Bristol lady. In 1699 he paid a second visit to the New World, and found Pennsylvania in a prosperous condition. His stay, which lasted two years, was marked by many useful measures, and by efforts to ameliorate the condition both of the Indians and Negroes. Penn departed for England towards the end of 1701, leaving the management of his affairs to a Quaker agent named Ford, whose villainy virtually ruined Penn. When the rogue died, he left to his widow and son false claims against his master, and these were so ruthlessly pressed, that Penn allowed himself to be thrown into the Fleet in 1708, to avoid extortion. His friends afterwards procured his release, but not till his constitution was fatally impaired. Penn died at Ruscombe, in Berkshire, July 30, 1718.



BENJAMIN FRANKLIN.

Benjamin Franklin.—The distinguished philosopher and statesman, Benjamin Franklin, was born at Boston, January 17, 1706. His parents were poor, and had a family of seventeen children, he being the fifteenth. Josiah

Franklin, his father, had left England in 1685, and settled in America, where he followed the business of soap-boiler and tallow chandler. At the age of eight, Franklin was sent to school, where he displayed great aptitude for learning. At twelve, he was apprenticed to his step-brother James, who had set up a printing shop in the place, and he soon acquired considerable proficiency at that trade. He was passionately fond of reading, and all the time he could spare he devoted to the perusal of such books as he could lay his hands on. His brother treated him unkindly, and he secretly left home



PATRICK HENRY.

and journeyed to New York, and thence to Philadelphia, where he procured employment in a printing office. He led a somewhat wandering life and endured many hardships, until in 1726, with the assistance of friends, he started in business for himself in Philadelphia. He became editor and proprietor of the *Gazette*, and published the famous "Poor Richard's Almanac." In 1730 he married a Miss Read. He founded the first association for extinguishing fires and the first company for insurance against fire, and through his instrumentality was established the first public library in Philadelphia. Among the public offices to which he was appointed were those of clerk to the General Assembly of Pennsylvania in 1736; postmaster of Philadelphia in 1737; representative of Philadelphia in the Assembly in 1747. In

1753, he was appointed Deputy Postmaster-General for the British colonies. In 1757, he was sent to England to settle some matters for the Assembly, and so ably did he perform his task, that Massachusetts, Maryland, and Georgia severally appointed him their English agent. In 1752 he discovered the identity of electricity with lightning, and turned his discovery to account by publishing a plan for defending houses from lightning by the use of pointed conductors. He likewise made important discoveries with regard to the laws that regulate the electric fluid, a subject hitherto very imperfectly understood. His renown was spread over the whole civilized world, and honors were heaped upon him by the various learned societies of Europe. He was elected a delegate to the Continental Congress in 1775, and from that time exerted himself to the utmost to obtain a Declaration of the Independence of the thirteen American States. This Declaration was pronounced by Congress on the 4th of July, 1776, and Franklin was appointed United States Minister at the Court of France, where he succeeded in inducing the French government to form an offensive and defensive alliance with

the States. On the 20th of January, 1782, Franklin had the supreme satisfaction of signing at Paris, with the English commissioners, the treaty of peace by which the independence of the American colonies was assured. Returning to America in 1785, he was successively chosen member and president of the supreme executive council for the city of Philadelphia, and in 1787 delegate for Pennsylvania to the convention for the revision and emendation of the Articles of Union. In 1788, he retired from public life, and died April 17, 1790, at the advanced age of 84.

Patrick Henry.—This eminent American orator was born in Hanover County, Virginia, in 1736. His father was a native of Scotland, and a nephew of Robertson, the celebrated historian. In early life, Henry seemed too indolent to apply himself to any regular occupation. He managed, however, to pick up much general information, and seemed to possess by intuition a profound knowledge of human nature in its various phases. Having failed successively in "store-keeping" and in farming, he was at length induced to try the profession of law. For a few years this seemed to promise no better success than his former occupations had done, but having been employed in 1755 to plead the cause of the people against an unpopular tax, his peculiar talent seemed

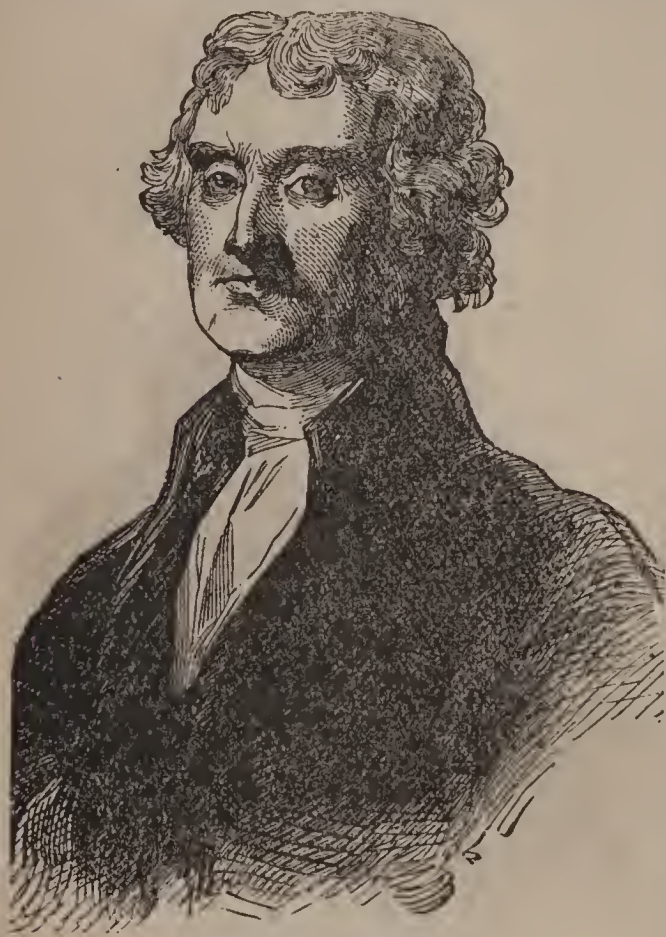
suddenly to develop itself; his eloquence, untaught except by the inspiration of native genius, thrilled the audience, and held it in rapt attention more than two hours. From that moment to the present day he has been universally regarded as the greatest of American orators. He was a zealous patriot in the war of the Revolution, and was one of the most prominent and influential members of the Virginia Legislature, when that State was deliberating whether or not to join Massachusetts in forcibly resisting the arbitrary policy of the home government. Henry was a delegate to the first general Congress, which met at Philadelphia, in September, 1774, and his voice was the first to break the silence of that assembly. His eloquence on that occasion is said to have astonished all his hearers. In 1776, he was elected Governor of Virginia, and was afterwards twice re-elected. In 1795, Washington appointed him Secretary of State. He died in 1799.

John Adams.—The second President of the United States was born at Braintree, in Massachusetts, on the 19th of October, 1735. His parents were descended from a Puritan family which had emigrated from England to Mas-



JOHN ADAMS.

sachusetts in 1640. Before the Revolution Adams had distinguished himself as a jurist, and wrote in the *Boston Journal* on "Canon Law and Feudal Law" (1765). He was sent by Massachusetts to the Congress which commenced its sittings in Philadelphia in 1774. With Lee and Jefferson he boldly argued for a separation from the mother-country; and Lee's proposition of a Declaration of Independence was carried on the 4th of July, 1776. Adams and Jefferson had been appointed to draw up the Declaration of Independence, but it appears that Jefferson was the sole author of it. In suc-



THOMAS JEFFERSON.

ceeding years, Adams was employed on many important negotiations with European powers; among others, he assisted Franklin, Jay, Jefferson and Laurens, in 1782, in settling the conditions of peace with England. In 1785 he went to London as the first ambassador from the Union. George III expressed his pleasure in receiving an ambassador who had no prejudices in favor of the French, the natural enemy of the English crown, and Adams replied: "I have no prejudices but in favor of my native land." He published in London his "Defence of the Constitutions of Government of the United States" (3 vols. 1787). On his return to America, in the same year, he was elected as Vice-President of the United States, and on the retirement of Washington (in 1797, became President. In

1801, when his term of four years of office had expired, his adversary Jefferson was elected by a majority of one vote. Adams now retired to his estate at Quincy, near Boston, where he occupied himself with agricultural pursuits. After this retirement, he received many proofs of respect and confidence from his countrymen. When 85 years old, we find him still in his place as member of the convention appointed (1820) to revise the Constitution of Massachusetts. He died on the 4th of July, 1826, on the fiftieth anniversary of the day when he had proclaimed in Congress the independence of the United States.

Thomas Jefferson.—The third President of the United States, Thomas Jefferson, was the son of a planter, and was born at Shadwell, Albemarle County, Virginia, April 2, 1743. He studied at William and Mary's College, Williamsburg; and after leaving college, was engaged for some years in the practice of law. In 1769, he was elected to the Virginia House of Burgesses, where he joined zealously with the revolutionary party. In 1773, as a Member of the Assembly, he took a prominent part in the measures which re-

sulted in the calling of the Continental Congress, to which he was sent as a delegate, where he drew up the celebrated Declaration of Independence. During the war in defence of this Declaration, he was Governor of Virginia, and in 1784 was sent Minister to France, where his manners, accomplishments, and more solid qualities did much to secure to America the powerful alliance that insured her success. Returning in 1789, he was appointed, by Washington, Secretary of State, a post due to his abilities, his influence, and his distinguished services. The Federal constitution had been adopted, and the two parties which soon divided the country began to develop themselves. Washington, John Adams, Jay, and Hamilton were in favor of a strong centralized government; Jefferson led the party in favor of States' rights, and a Federal Government of restricted and carefully defined powers. The first party took the name of Federalists; the latter were first called Anti-Federalists, then Republicans, and finally adopted the title first given them, as a reproach, of Democrats. When Washington retired, after eight years of office as President, a new election took place, the two highest candidates, as leaders of the opposing parties, were John Adams and Jefferson. Adams, having the largest vote, was declared President, while Jefferson, having the next highest number, became the Vice-President, 1797. The strife of these parties culminated in 1800, when Jefferson and Aaron Burr were elected President and Vice-President, against John Adams, the Federal candidate. On entering upon the Presidency, he reduced the government to a republican simplicity, made few removals, and resolutely refused to appoint any of his own relatives to office. The most important act of his administration was the purchase of Louisiana from France. At the end of eight years, he retired to his residence at Monticello.* His death was very remarkable; it occurred on the 4th of July, 1826, while the nation was celebrating the fiftieth anniversary of the Declaration of Independence, which he had written. On the same day, and almost at the same hour, John Adams, the second President, who had signed with him the Declaration, died in New England.



ALEXANDER HAMILTON.

Alexander Hamilton.—This celebrated American statesman was born in January, 1757, in the West Indian island of Nevis, and was the son of a Scotch merchant who had married a young French widow. His father soon failed in business, and Alexander, at the age of twelve, had to enter the

counting-house of a rich American merchant, named Cruger. His extraordinary abilities, however, induced some of his friends to procure for him a better education than could be got at home. He was accordingly sent to a grammar-school at Elizabethtown, New Jersey; and shortly afterwards entered Columbia College, New York. On the first appearance of disagreement between Great Britain and her colonies, Hamilton, still a schoolboy, and barely eighteen, wrote a series of papers in defence of the rights of the latter, which were at first taken for the production of the eminent statesman



JOHN JACOB ASTOR.

Jay, and which secured for the writer the notice and consideration of the popular leaders. On the outbreak of the war, he obtained a commission as Captain of Artillery, gained the confidence of Washington, was made his aide-de-camp in 1777, and acquired the greatest influence with him as his friend and adviser. In 1780, he married a daughter of General Schuyler, who was a member of a very old family. On the termination of the war, he left the service with the rank of Colonel, and betaking himself to legal studies, soon became one of the most eminent lawyers in New York. In 1782, he was elected by the State of New York a Representative at the Continental Congress; in 1786, he became a member of the New York Legislature; and in 1787, he was appointed one of the delegates to the convention which met at Philadelphia, for the purpose of re-

vising the Articles of Confederation. In conjunction with Madison, he had the most important share in drawing up the Constitution afterward adopted. He was a strong supporter of the Federal, as opposed to the Democratic party; and, with Jay and Madison, defended the Constitution against all attacks, by a series of letters in the *Daily Advertiser*, of New York, afterwards collected and published under the title of "The Federalist." On the establishment of the new government in 1789, with Washington as President, Hamilton was appointed Secretary of the Treasury. In 1795, he resigned his office, and resumed the practice of law in New York. When the war with France broke out in 1798, he was, according to the wish of Washington, made Major-General of the United States Army; and, on the death of Washington, he succeeded to the chief command. When peace was restored, he returned to his civil duties, but became involved in a political quarrel with Aaron Burr. This difference unhappily culminated in a duel, in which Hamilton received a wound, of which he died the following day (July 12, 1804).

John Jacob Astor.—This enterprising merchant, founder of the American Fur Company, was born in a village near Heidelberg, in Germany, 1763. After spending some years in London, he sailed to America in 1783, and soon invested his small capital in furs. By economy and industry, he so increased his means that after six years he had acquired a fortune of \$200,000. Although the increasing influence of the English fur companies in North America was unfavorable to his plans, he now ventured to fit out two expeditions to the Oregon territory—one by land and one by sea—the purpose of which was to open up a regular commercial interest with the natives. After many mishaps, his object was achieved in 1811, and the furtrading station of Astoria was established; but the war of 1812 stopped its prosperity for a time. From this period Astor's commercial connections extended over the entire globe, and his ships were found in every sea. He died in 1848, leaving property amounting to \$30,000,000. He left a legacy of \$350,000 for the establishment of a public library in New York. His wealth was mainly inherited by his son, William, who continued to augment it till his death in 1875, when he is said to have left \$50,000,000. He added \$200,000 to his father's bequest for a public library. He was known as the "landlord of New York" from the extent of his property in that city.



ROBERT FULTON.

Robert Fulton.—The celebrated American engineer, Robert Fulton, was born at Little Britain, Pennsylvania. His parents belonged to Ireland, whence they emigrated to America; and being in poor circumstances, all the education young Fulton acquired was the ability to read and write. When he was old enough, his mother apprenticed him to a jeweler in Philadelphia. In addition to his labors at this trade, he devoted himself to painting; and the sale of his portraits and landscapes enabled him, in the space of four years, to purchase a small farm, on which he placed his mother, his father being dead. At the age of twenty-two, he proceeded to London, where he studied painting under West; but after several years spent thus, he abandoned painting, and applied himself wholly to mechanics. In 1794, he obtained from the British government a patent for an inclined plane, the object of which was to set aside the use of locks; and in the same year, he invented a mill for sawing and polishing marble. His next invention was a machine for spinning flax, followed by one for making ropes. He was received as a civil engineer in 1795; and wrote a work on

canals, in which he developed his system. Accepting an invitation from the United States Minister at Paris, he proceeded to that city in 1796, and remained there for seven years, devoting himself to new projects and inventions. Amongst his inventions here was the *nautilus* or submarine boat, intended to be used in naval warfare, which he in vain sought the French government to accept; nor was he more successful with the British government, which he next tried, though commissions were appointed in both



ANDREW JACKSON.

cases to test the value of his invention. Having failed in this matter, he next turned his attention to the application of steam to navigation. In 1803, he constructed a small steamboat, and his experiments with it on the Seine were attended with great success. He returned in 1806 to New York, and pursued his experiments there. He perfected his Torpedo system, which was afterwards employed effectively in the war between Britain and America. In 1807, he launched a steam-vessel upon the Hudson, which made a successful start, in the presence of thousands of astonished spectators. From this period, steamers (for the construction of which Fulton received a patent from the Legislature) came into pretty general use upon the rivers of the United States. Although Fulton was not the first to apply steam to navigation, as a steam

vessel had been tried upon the Forth and Clyde Canal as early as 1789, yet he was the first to apply it with any degree of success. He died in 1815.

Andrew Jackson.—This famous General and seventh President of the United States was born at Waxaw settlement, South Carolina, March 15, 1767. His father, who was a Scotchman by birth, emigrated to America in 1765, and soon afterwards died, leaving to his widow a half-cleared farm in a new settlement, with no negroes to assist in its cultivation. When Jackson grew up, he was sent to study for the church, but on the breaking out of the American Revolution, he and his brothers were summoned to the field, and the elder lost his life at Stono Ferry. Andrew, though but thirteen years old, fought with his remaining brother under Sumter, and remained with the army until the end of the war. In 1784 he commenced the study of law, and in 1787 was appointed solicitor for the western district of South Carolina, now the State of Tennessee. This frontier settlement had for its neighbors several powerful tribes of Indians, against whom Jackson fought with such success as to get from them the complimentary titles of "Sharp Knife"

and "Pointed Arrow." In 1796, he was a member of the convention which modeled the Constitution and organized the State of Tennessee, and was elected to the Legislature as Representative, and then as Senator, and appointed Judge of the Supreme Court (an office he soon resigned), and Major-General of the State Militia. In 1813, at an outbreak of hostilities with the Creek Indians, he raised a volunteer force of two or three thousand men, and defeated them. When destitute of supplies, he is said to have set an example of endurance by feeding on hickory-nuts, and hence, according to some, to have acquired the popular sobriquet of "Old Hickory." Jackson's final victory (March 27, 1814) at the Horseshoe peninsula, in the Tallahoosa, completely broke the power of the Indian race in North America. In consequence of his skill and energy in Indian warfare, he was appointed a Major-General of the Army of the United States; and in the contemporaneous war with England had command of the forces which captured Pensacola, and defended New Orleans against the attack of the British under General Packenham, December, 1814. After Spain had ceded Florida to the United States, he was made Governor of the territory and subsequently was chosen United States Senator from Tennessee. In 1824, he received the highest vote of four candidates for the Presidency of the United States, but by the influence of Mr. Clay, John Quincy Adams was elected by the House of Representatives. He was, however, in spite of bitter and violent opposition, elected by the Democratic party in 1828, and in 1832 re-elected by a still more overwhelming majority. His administration was marked by singular firmness. He vetoed important measures against large majorities, and, after a long struggle, destroyed the Bank of the United States, and took the first steps towards a specie currency and independent treasury. He died at his farm of the Hermitage, near Nashville, June 8, 1845.

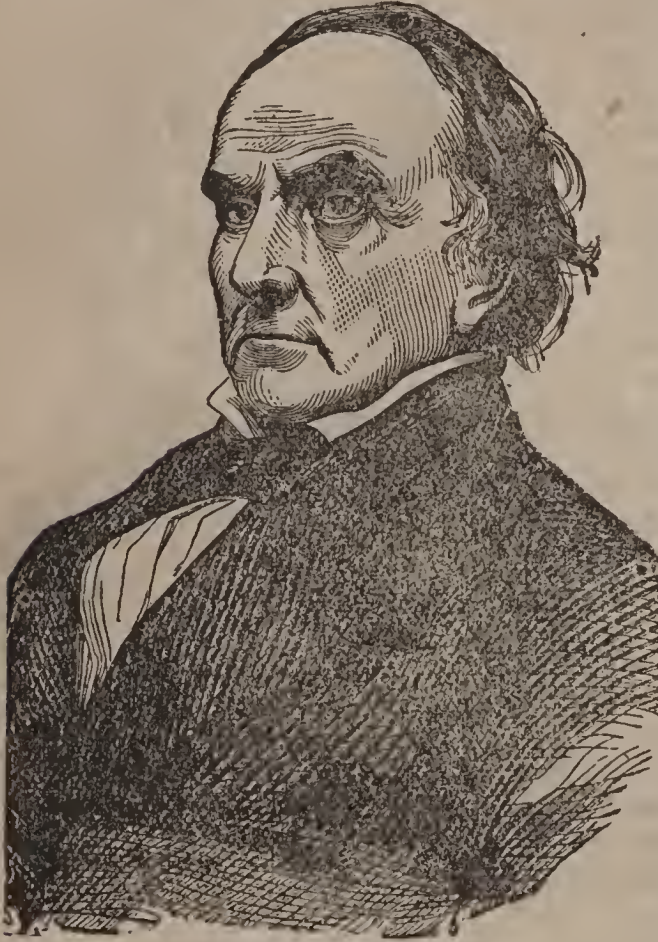


HENRY CLAY.

Henry Clay.—The famous American statesman, Henry Clay, was born April 12, 1777, in Hanover County, Virginia. He early devoted himself to the law, and fixing his residence at Lexington, Kentucky, soon obtained a lucrative practice and political influence enough to be elected to the State Legislature. In 1806 he was elected to Congress, and again in 1809 he was chosen Senator for a term of two years. In 1811 he was sent to the House of Representatives, where he was immediately elected Speaker. A strong

advocate of nationality, he denounced the claims put forth by England as to right of search; he was a strenuous supporter of the war with that country, and in consequence was sent, in 1814, as one of the commissioners to sign the treaty of peace at Ghent, where his acuteness secured for America many advantages. On his return, he exerted all his talents in favor of the independence of South America, and labored hard to eradicate all European influence from the American continent. Clay, however, is best known as the author of the famous "Missouri Compromise," restricting slavery to the

States south of $36^{\circ} 30'$ n. lat.; and also for the compromise of 1850, known as Clay's "Omnibus" measure. He died in June, 1852. He was very popular during his lifetime, and was two or three times proposed for the Presidency, an honor, however, which he never succeeded in obtaining.



DANIEL WEBSTER.

Daniel Webster.—The great American statesman and jurist, Daniel Webster, was born at Salisbury, New Hampshire, January 18, 1782, and was the second son of Ebenezer Webster, a small farmer, and Justice of the County Court. He entered Dartmouth College in 1797, and taught school in winter to pay his expenses, and aid his brother, Ezekiel, who became a distinguished lawyer, in fitting for college. On graduating in 1801, he commenced to study law, but was induced, by the offer of a salary of \$350 a year,

to become preceptor of an academy at Fryburg, Maine, paying his board by copying deeds. In 1804, he went to Boston, and entered the law office of Mr. Gore, refusing an appointment of clerk of the court of which his father was a judge, at \$1,500 a year. In 1805, having been admitted to the Boston bar, he established himself at Portsmouth, New Hampshire; married in 1808; and having engaged in politics as a member of the Federalist party, was elected to Congress, where he immediately took rank with the foremost men of the country. His speech on the Berlin and Milan Decrees, and his mastery of the question of currency and finance, gave him a high position; but he determined, in 1816, to remove to Boston, where, leaving politics, he engaged for several years in legal practice of the most extensive and varied character. In 1822 he was elected to Congress from Boston, and was distinguished by his speeches on the Holy Alliance and the Greek Revolution, and his labors in the revision of the criminal laws of the United States. In 1826, he was chosen Senator; and in 1830, he rose to the height of his forensic renown in a speech of two days, in the debate with Mr. Hayne, of

South Carolina, on the right of "nullification." Webster and Clay were the leaders of the opposition during the administrations of Jackson and Van Buren. In 1839, he visited England, Scotland and France; and in 1841, accepted the post of Secretary of State in the Cabinet of General Harrison, and remained in that of Mr. Tyler, who, as Vice-President, succeeded on the death of the President, until 1843. In 1844, he aspired to the Presidency, but the choice of his party fell upon Mr. Clay, whom he supported, but unsuccessfully. He was chosen Senator for Massachusetts, and again in 1848 was disappointed of the Presidential nomination by the popular enthusiasm for General Taylor. His senatorial efforts at this period were directed to the preservation of the Union by the advocacy of compromises on the slavery question, and he gave offence to the Abolitionists by defending the Fugitive Slave Law. In 1850, he became again Secretary of State in the Cabinet of Mr. Fillmore; and in 1852 was once more, and no doubt grievously, disappointed at not receiving the nomination to the Presidency, which was given to General Scott. He did not live to see the defeat of his rival; but after a brief illness, died at his country residence at Marshfield, Massachusetts, October 24, 1852.

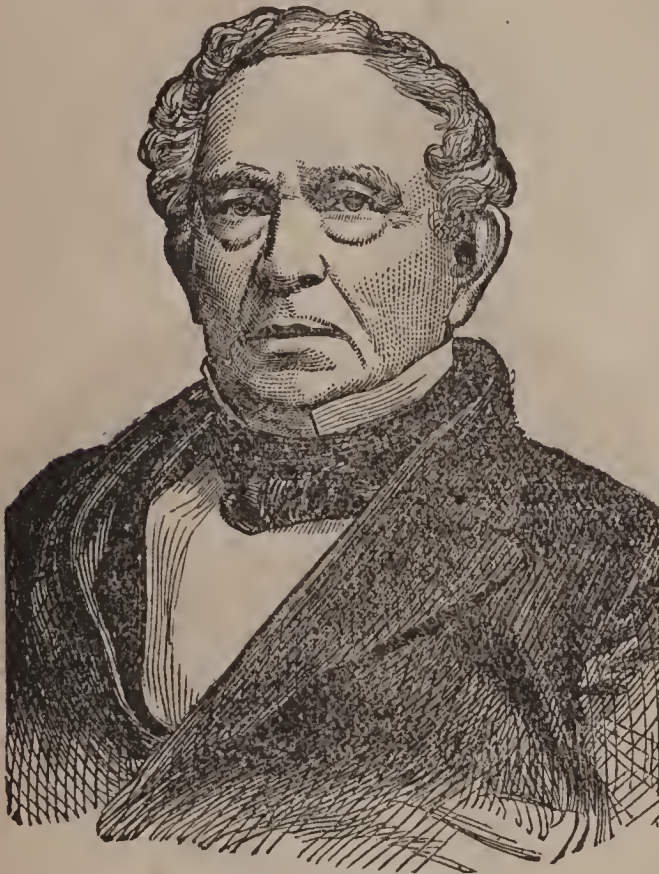


GEORGE PEABODY.

George Peabody.—This name deserves to be held in remembrance on account of his munificent philanthropy. He was born at Danvers, Massachusetts, February 18, 1795. His parents were poor, and his only education was received at the district school. At the age of eleven he was placed with a grocer, and at fifteen in a haberdasher's shop in Newburyport. When twenty-two years old, he was a partner with Elisha Riggs in Baltimore. In 1827 he first visited England, where he settled permanently ten years later. Withdrawing from the Baltimore firm in 1843, he established himself in London as a merchant and money-broker, and accumulated a large fortune. As one of three commissioners appointed in 1848 by the State of Maryland to obtain the restoration of its credit, he refused all payment, and received a special vote of thanks from the Legislature of that State. In 1851 he supplied the sum required to fit up the American Department at the great exhibition. In the following year he sent a large donation, afterwards increased to \$270,000, to found an Educational Institute, etc., in his native town of Danvers (which is now called Peabody). He contributed \$10,000 to

the first Grinnell Arctic Expedition; \$1,400,000 to the city of Baltimore for an Institute of Science, Literature and the Fine Arts; \$8,000,000 for the promotion of education, endowment of libraries, etc., in the United States. From 1862 to 1868, he gave \$1,750,000 for the benefit of the London poor, and in his will he left \$750,000 for the same purpose. This vast sum has been employed in building dwellings for the working-classes. He died in London in 1869.

Edward Everett.—This distinguished American was born in 1794, at Dorchester, near Boston, Massachusetts, entered Harvard College in 1807,



EDWARD EVERETT.

and took his degree in 1811. He was for some time a Unitarian clergyman in the town of Cambridge, and in this capacity had the reputation of being one of the most eloquent and pathetic preachers in the United States. In 1815, he was elected Professor of the Greek Language and Literature in Harvard College; and to qualify himself more thoroughly for his work, he visited Europe, where he resided for four years, and had a distinguished circle of acquaintance—including Scott, Byron, Jeffrey, Romilly, Davy, etc. M. Cousin, the French philosopher and translator of Plato, pronounced him "one of the best Grecians he ever knew." In 1820, Everett became editor of *The North American Review*; and in 1824, a Member of the United States Congress, sitting in the House of Repre-

sentatives for ten years. In 1835, he was appointed Governor of Massachusetts; and in 1841, Minister Plenipotentiary to the Court of St. James. While in England, he received from the universities of Oxford, Cambridge, and Dublin the degree of D.C.L. On his return to America in 1845, he was elected President of Harvard College; on the decease of Daniel Webster, he became Secretary of State; and in 1853, the Legislature of Massachusetts chose him as member of the Senate of the United States. He died in January, 1865. Mr. Everett's principal works are: "A Defence of Christianity" (1814); "Orations and Speeches on Various Occasions from 1825 to 1836" (1836); and "Orations and Speeches on Various Occasions from 1825 to 1850." This includes all the previous orations. These "Orations," as they are called, are upon all subjects, and indicate a varied, vigorous, and flexible genius.

James Fenimore Cooper.—The celebrated novelist, James Fenimore Cooper, was born at Burlington, New Jersey, September 15, 1789. Having

received his early education from a private tutor, he, at the age of thirteen, passed to Yale College, and after three years' study there, entered the American navy as a midshipman. He remained six years at sea, gathering the experience of which he was afterwards to make such good use in his novels. On his retirement from the sea in 1811, he married; and the next ten years of his life were spent in a quiet, domestic fashion. In 1821 appeared his first work, "Precantion," a novel that afforded no indication whatever of the talent he subsequently exhibited. In the following year,

however, he published "The Spy," a tale which at once secured for him a place in the first rank of novelists. By not a few critics he was even elevated to a higher pedestal than that which Scott occupied; but time sobered their judgment, while it still left him a deservedly high position as a writer of fiction. In quick succession followed "The Pioneers," "The Pilot," "The Last of the Mohicans," "The Red Rover," and "The Prairie," with which Cooper's genius culminated; for though between this date (1827) and 1850 he wrote about twenty-six different works, none of them equalled in merit those we have mentioned. The secret of Cooper's success as a novelist lies in his graphic descriptive powers, and his thorough knowledge of the matters he describes, whether it be the boundless ocean or



JAMES FENIMORE COOPER.

the broad prairie, together with an attentive study of character. Not a little of his popularity in America, however, must be attributed to his nationality; and in Europe a good deal of it was owing to the freshness of the scenes in which his stories were laid. About 1827, Cooper visited Europe, where he remained several years; the fruits of his sojourn, besides novels, being some ten volumes of sketches of European society. Many of his works have been translated into most modern languages, and one — "The Spy" — can be read in Persian. He died at Cooperstown, in the State of New York, September 4, 1851.

Washington Irving.—This distinguished American author was born in the city of New York, April 3, 1783. At the age of sixteen he entered a law office; but he profited largely by his father's well-stocked library, Chaucer and Spenser being his favorite authors. New York, at this period, was a small town of about 50,000 inhabitants, many of whom were descendants of the original Dutch settlers, having quaint manners and customs, of which Irving was a curious observer. In 1807, he contributed a series of genial and

humorous essays to a periodical called *Salmagundi*. In 1809, he wrote "A History of New York, from the Beginning of the World to the End of the Dutch Dynasty, by Diedrick Knickerbocker." Having no inclination for law, he engaged in commerce with his brothers as a silent partner, but devoted his time to literature, and in 1813 edited the *Analectic Magazine*, in Philadelphia. At the close of the war in 1815, he visited England. While he was enjoying his English visit, his commercial house failed, and he was suddenly reduced to poverty, and the necessity of writing for his bread. The "Sketch



WASHINGTON IRVING.

Book," which soon after appeared, was received with great favor. Irving went to Paris, and in 1822 wrote "Bracebridge Hall," and in 1824 the "Tales of a Traveler." He was then invited by Everett, the American ambassador to Spain, to accompany him to Madrid to translate documents connected with the life of Columbus. With these materials he wrote his "History of the Life and Voyages of Columbus" (1828); "Voyages of the Companions of Columbus;" "The Conquest of Granada;" "The Alhambra" (1832), a portion of which was written in the ancient palace of the Moorish kings; "Legends of the Conquest of Spain" (1835); and "Mahomet and his Successors" (1849). In 1829, he returned to England as Secretary to the American Lega-

tion. In 1831, he received the honorary degree of LL. D. from the university of Oxford; and next year returned to America, where he was welcomed with great enthusiasm. A visit to the Rocky Mountains produced his "Tour on the Prairies." He also contributed sketches of Abbotsford and Newstead Abbey to the "Crayon Miscellany," and from the papers of John Jacob Astor, wrote "Astoria" (1837), and the "Adventures of Captain Bonneville;" also a series of stories and essays in the *Knickerbocker Magazine*, collected under the title of "Wolfert's Roost." In 1842, he was appointed Minister to Spain. In 1846 was published his "Life of Goldsmith;" and his great work, the "Life of Washington," was published in 1855-1859. He spent the last years of his life at Sunnyside, in his own "Sleepy Hollow," on the banks of the Hudson, near Tarrytown, with his nieces, where he died suddenly of disease of the heart, November 28, 1859. He was never married.

Abraham Lincoln.—The sixteenth President of the United States, Abraham Lincoln, was born in Kentucky, February 12, 1809. His grandfather was an emigrant from Virginia; his father, a poor farmer, who, in 1806, removed from Kentucky to Indiana. In the rude life of the backwoods, Lincoln's entire schooling did not exceed one year, and he was on-

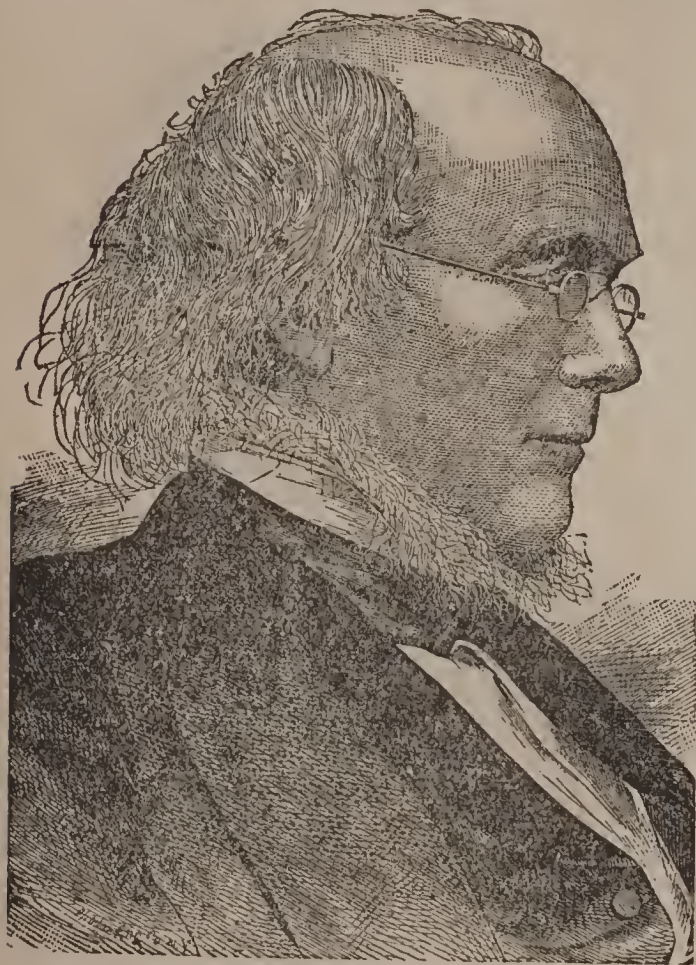
ployed in the severest agricultural labor. He lived with his family in Spencer County, Indiana, till 1830, when he removed to Illinois, where, with another man, he performed the feat of splitting 3,000 rails in a day, which gave him the popular *sobriquet* of "the Railsplitter." In 1834, he was elected to the Illinois Legislature. At this period, he lived by surveying land, wore patched homespun clothes, and spent his leisure hours in studying law. He was three times re-elected to the Legislature; was admitted to practice law in 1836; and removed to Springfield, the State capital. In 1844, he canvassed the State for Mr. Clay, then nominated for President. Mr. Clay was defeated, but the popularity gained by Lincoln in the canvass secured his own election to Congress in 1846, where he voted against the extension of slavery; and in 1854 was a recognized leader in the newly-formed Republican party. In 1855, he canvassed the State as a candidate for United States Senator, against Mr. Douglas, but without success. In 1856, he was an active supporter of Mr. Fremont in the Presidential canvass which resulted in the election of Mr. Buchanan. In 1860, he was nominated for the Presidency by the Chicago Convention. The non-extension of slavery to the Territories or new States to be formed from them, was the most important principle of his party. There were three other candidates, but Mr. Lincoln received a majority of votes over any of the other candidates. He was inaugurated March 4, 1861. His election by a sectional vote and on a sectional issue hostile to the South, was followed by the secession of eleven Southern States, and a war for the restoration of the union. As a military measure, he proclaimed, January 1, 1863, the freedom of all slaves in the rebel States; and was re-elected to the Presidency in 1864. The war was brought to a close, April 2, 1865; and on the 15th of the same month Lincoln was cut off by the hand of an assassin. He was characterized by a strong sense of duty and great firmness.



ABRAHAM LINCOLN.

Horace Greeley.—The great American journalist, Horace Greeley, was born at Amherst, New Hampshire, February 3, 1811. His father was a farmer of small means; and Horace, after acquiring the rudiments of education at a common school, entered a printing office as an apprentice in 1825, at Putney, Vermont. On the completion of his apprenticeship, he removed to New York City and worked for some time as a journeyman printer, and in 1834 commenced the publication of the *New Yorker*, a literary weekly paper, for which he wrote essays, poetry, and other articles. After one or two other essays at editorship, he began in 1841 the *New York Tribune*, of which

he was the leading editor until a short time previous to his death. As Mr. Greeley had adopted, to some extent, the social theories of Fourier, he was joined by the most able writers of that school of Socialism, and the paper was published as a joint-stock concern, being held in shares by its writers and others engaged in its publication. The *Tribune* has been an earnest advocate of temperance, woman's rights, the abolition of slavery and capital punishment, and other reforms, and is recognized as the organ of the Republican party. In 1848, Mr. Greeley was elected to Congress from one of



HORACE GREELEY.

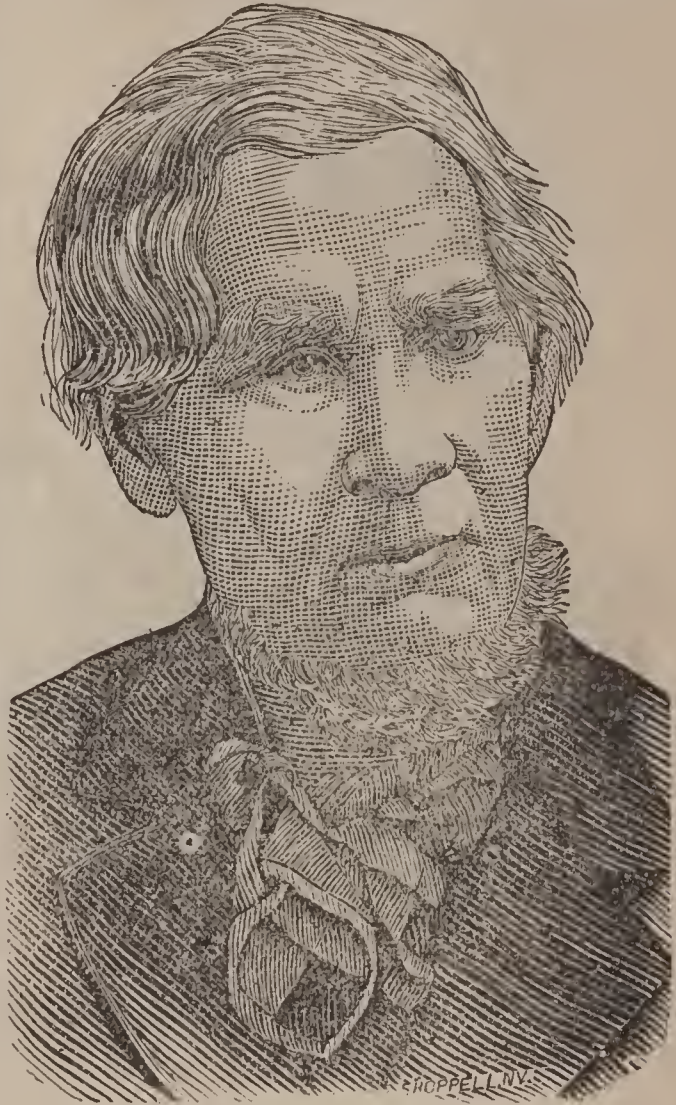
the districts of New York, for the short term, but failed in his congressional career by agitating an unwelcome reform in the mileage payments to members. In 1851 he visited Europe, and was chairman of one of the committees of the great exhibition. His aspirations to political position were defeated by the more conservative party leaders, and he, in turn, is supposed to have secured the election of Mr. Lincoln, instead of Mr. Seward, in 1860. On the secession of the Southern States from the Union, Mr. Greeley at first advocated their right to secede, in accordance with the principles of the Declaration of Independence; but when the war began, he became one of its most zealous advocates, and is supposed to have caused the premature ad-

vance that resulted in the defeat of Bull's Run, July 21, 1861. In 1872, he was a candidate for the Presidency, being nominated by the "Liberal" Republican party of that period, and endorsed by the Democratic party, but was defeated by his opponent, General Grant. He died the same year. He is the author of "The American Conflict," "Essays on Political Economy," "Recollections of a Busy Life," "What I Know About Farming," and other popular works.

Thurlow Weed.—From the most humble origin Thurlow Weed rose by slow degrees until he became one of the leading journalists of the United States and the greatest political leader of his time. He was born at Cairo, Greene County, New York, November 15, 1797. His parents were poor, and his opportunities of procuring an education very limited. At the age of ten years he was cabin-boy on a sloop on the Hudson River; at twelve he was an apprentice in the printing office of Mr. Croswell, at Catskill; he then lived for a short time in a backwoods settlement, but at fourteen returned

to printing. In early life he was singularly uncouth and awkward in appearance, so much so that he frequently excited the ridicule of his associates. When the war of 1812 began, young Weed volunteered into the American army. At his majority he owned a newspaper. In 1826 and 1827 he was engaged in editing the *Anti-Masonic Enquirer*. Twice elected to the Assembly of the Empire State, he never afterwards accepted a political position, however important, honorable or remunerative.

Mr. Weed was a clever party manager, and is given a large share of the credit due to the men who secured the election of De Witt Clinton as Governor of New York. In 1830 he settled at Albany, and commenced the publication of the *Evening Journal*, an anti-Jackson, Whig, or Republican paper, which became the organ of the party, and of the State government when its party was in power. He is supposed to have exercised almost supreme influence in nominations and appointments, and to have secured the choice of Presidents Harrison and Taylor. Throughout his whole career he was the friend and adviser of Mr. Seward, and he was also a member of the famous political firm of Seward, Weed & Greeley. When Mr. Weed visited Europe in 1861, he was received with marked distinction, due to a prominent journalist, politician and diplomatist. He retired from the

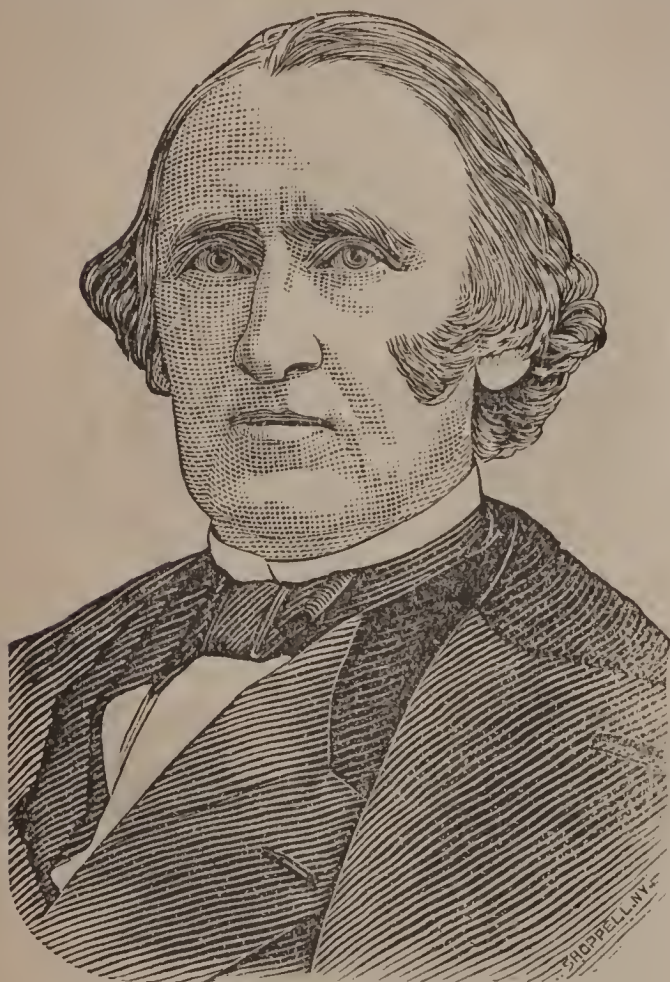


THURLOW WEED.

Albany *Evening Journal* in 1862, but so lately as 1880 contributed to its columns in the shape of an article recording his half a century's connection with public life. He was connected both with the *New York Times* and the *Commercial Advertiser* in the later years of his career. Mr. Weed was the author of a volume of letters addressed from Europe and the West Indies, and of an interesting and valuable book on his personal reminiscences. He died in New York City in the year 1882.

Wendell Phillips.—The great Anti-Slavery agitator, Wendell Phillips, was born in Boston, November 29, 1811, and was the son of the first Mayor of that city. He was educated at Harvard, where he was graduated in the year 1831. He studied law at the Cambridge Law School, and was admitted to the bar in 1834, one year after his graduation there. He practiced his profession until 1839, when he retired in consequence of his unwill-

ingness to be bound by an oath of fidelity to the Constitution, as at that time construed by the supreme court. At a meeting in Faneuil Hall, Boston, in December, 1837, in an impromptu speech of great eloquence, he made his first public appearance as a reformer, and from that time he became known to the public as a prominent agitator in the Anti-Slavery, Temperance, and



WENDELL PHILLIPS.

Woman's Rights reforms. During the early stage of the civil war, he advocated the emancipation of the slaves in a wonderfully energetic and eloquent manner, and after this reform was accomplished continued a member of the Anti-Slavery Society, which was not dissolved until 1870. Mr. Phillips had been its President continuously as the immediate successor of William Lloyd Garrison. In 1870 he was the candidate of the "Labor-Reform" party for Governor of Massachusetts. He strenuously opposed the policy of President Hayes towards the Southern States, and his views on the Irish and other political and social questions are well known. He published many pamphlets upon the subjects which so engrossed his thoughts. In 1863 was published an edition of his speeches, lectures and letters. For finished and

impressive address, elegance and grace of delivery, he was incomparable among the orators of his time. He died in 1884, at the age of seventy-three years.

Henry Ward Beecher.—No man in the United States has been written about more than Henry Ward Beecher, but the main facts of his life are told in a few words. He is a native of Litchfield, Connecticut, where he was born on the 24th of June, 1813. His father was the sturdy Rev. Dr. Lyman Beecher, who rose from the anvil to be the leader of orthodoxy in New England. The future pastor of Plymouth Church was graduated at Amherst in 1834. He studied theology at Lane Seminary, and in 1837 became pastor of a church at Lawrenceburg. In 1839 he accepted a call to Indianapolis, where he remained eight years, after which Plymouth Church, Brooklyn, became the scene of his distinguished efforts as a preacher. Before the war Mr. Beecher was long distinguished among the opponents of slavery. During its progress he visited Great Britain as a representative of the Union cause, where his eloquence assisted the efforts of the journalists, religious teachers and other persons who took the same view of the struggle as he

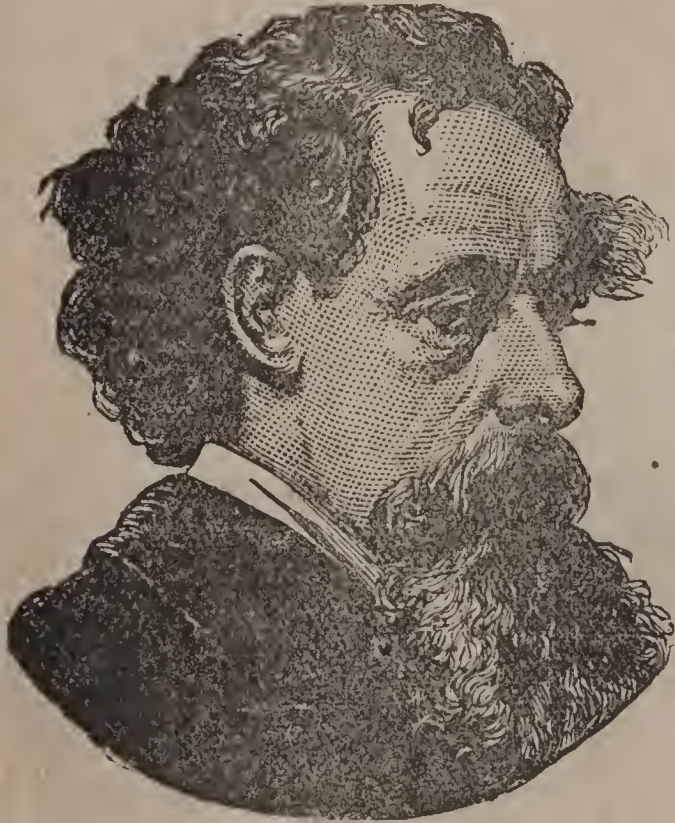
did. Jealousy of the rapid prosperity of this country, the dislike of British manufacturers to our protective system, their business relations with the planters of the South, the interests of the aristocracy, who foresaw mischief to their privileges in the success of popular government, and, on the part of many who were disposed to side with the Union, their non-apprehension of the reason which delayed the abolition of slavery, may be mentioned as among the causes which led to an unfriendly attitude of Great Britain towards the Northern cause at the time of the war, when, on the other hand, the non-conformist and radical section of its people favored it. Mr. Beecher met with opposition in his mission, and with great kindness as well. His oratorical gifts were at their best, and he returned after a campaign which did great credit to his abilities and proved of much value to the cause he promoted. As a preacher and lecturer the subject of this sketch takes the highest rank, and as a writer enjoys distinction. His versatility is wonderful, his liberality of thought and sentiments not less extraordinary. His personal appearance and the peculiar fascination of his address, whether in private or public, are so well known that nothing need to be said of them here. While opinion is divided as to the effect of his life and teaching, critics, both friendly and unfriendly, are at one in regarding Beecher as a great man.



HENRY WARD BEECHER.

Charles Sumner.—This famous American statesman was born at Boston, Massachusetts, January 6, 1811. His father was a lawyer, and for many years sheriff of the county. He was educated at Harvard College, where he graduated in 1830; studied law at the Cambridge Law School; was admitted to the Bar in 1834, and entered upon a large practice; edited the *American Jurist*; published three volumes of Sumner's "Reports of the Circuit Court of the United States;" gave lectures at the Law School, but declined a proffered professorship; and from 1837 to 1840, visited England and the continent of Europe. On his return, he edited Vesey's "Reports," in twenty volumes, and in 1845, made his *debut* in politics in a 4th of July oration on the "True Grandeur of Nations"—an oration directed against the war with Mexico, pronounced by Mr. Cobden the noblest contribution by any modern writer to the cause of peace. Identifying himself with the Free-soil party, he was, in 1850, chosen United States Senator from Massachusetts,

in place of Daniel Webster, where he opposed the Fugitive Slave law, and declared "freedom national—slavery sectional." In 1856, he made a two days' speech on "The Crime Against Kansas," some of which was of a violent personal character, in consequence of which he was attacked in the Senate Chamber, May 22d, and severely beaten by Preston C. Brooks, and so severely injured that his labors were suspended three or four years, during which he visited Europe for repose and health. Returning to the Senate, he supported the election of Mr. Lincoln, urged upon him the Proclamation



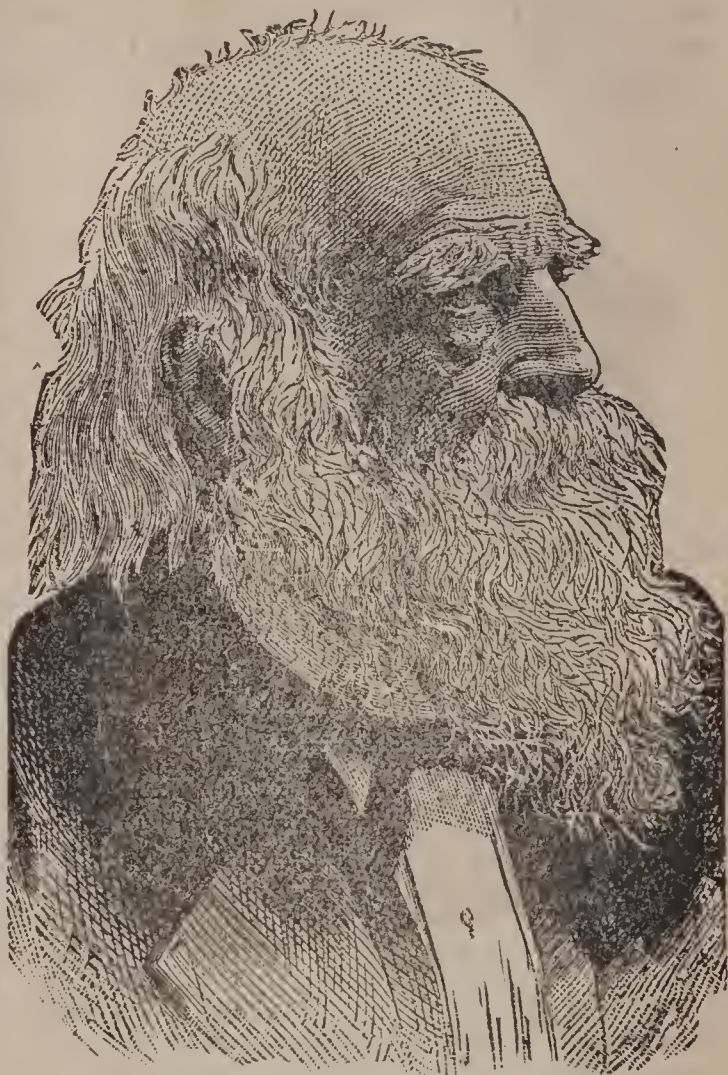
CHARLES DICKENS.

of Emancipation, and became the leader of the Senate, as chairman of the Committee on Foreign Relations. In 1862 he was again elected a Senator, and re-elected in 1869. In 1871 he opposed the annexation of Hayti to the United States. He published "White Slavery in the Barbary States" (1853), "Orations and Speeches" (1850), etc. He died in 1874.

Charles Dickens.—The great English novelist and humorist, Charles Dickens, was born at Landport, in Hampshire, in February, 1812. His father, Mr. John Dickens, was employed for some years in the Navy Pay Department, but at the conclusion of the war with France was pensioned, and

became a parliamentary reporter. In this pursuit his son was soon distinguished for uncommon ability, and after a literary engagement, at a very early age, upon *The True Sun*, he became connected with *The Morning Chronicle*. In this newspaper he gave the first evidence of his talents in the lively essays entitled "Sketches by Boz," published in 1836. Encouraged by their success he next produced the famous "Pickwick Papers," which had an enormous commercial success and began an era in English literature, being the first of a series of fictitious works exhibiting the life and manners of the middle and lower classes, which up to that time had had scarcely any exponent. Mr. Dickens's fame was now thoroughly established upon both sides of the Atlantic, and each new work as it emanated from his pen was read with eager interest. In due season appeared "Nicholas Nickleby," "Hard Times," "The Old Curiosity Shop," "Barnaby Rudge," "A Tale of Two Cities," "David Copperfield," "Martin Chuzzlewit," "American Notes," "Dombey and Son," "Bleak House," "Little Dorrit," "Great Expectations," "Oliver Twist," "Christmas Stories," and "Our Mutual Friend." At the time of his death, June 9, 1870, he was engaged upon a novel entitled "The Mystery of Edwin Drood," which was left unfinished. Mr. Dickens visited America in 1842 and again in 1867, giving numerous readings and meeting with a brilliant reception.

William Cullen Bryant.—This famous poet and journalist was born in Cummington, Hampshire County, Massachusetts, on November 3, 1794. He was the son of a physician, a gentleman of culture, who took great pride in his promising son, whose poetic talents were early made manifest. At the early age of ten he made translations from some of the Latin poets and contributed rhymes to the local newspapers. When scarcely thirteen years of age he wrote a terse and vigorous political poem entitled "The Embargo." At eighteen he composed his "Thanatopsis," a poem full of beauty and usually regarded as the greatest literary production of his life. In 1810 Mr. Bryant entered Williams' College, and choosing the law as a profession, was admitted to the Bar five years later. He practiced for ten years with diligence and success, first at Plainfield and afterward at Great Barrington, but his tastes inclined to literature, and in 1825 he went to New York, where he became associated with Richard H. Dana as editor of the *New York Review*. In 1826 he became principal editor of *The Evening Post*, one of the

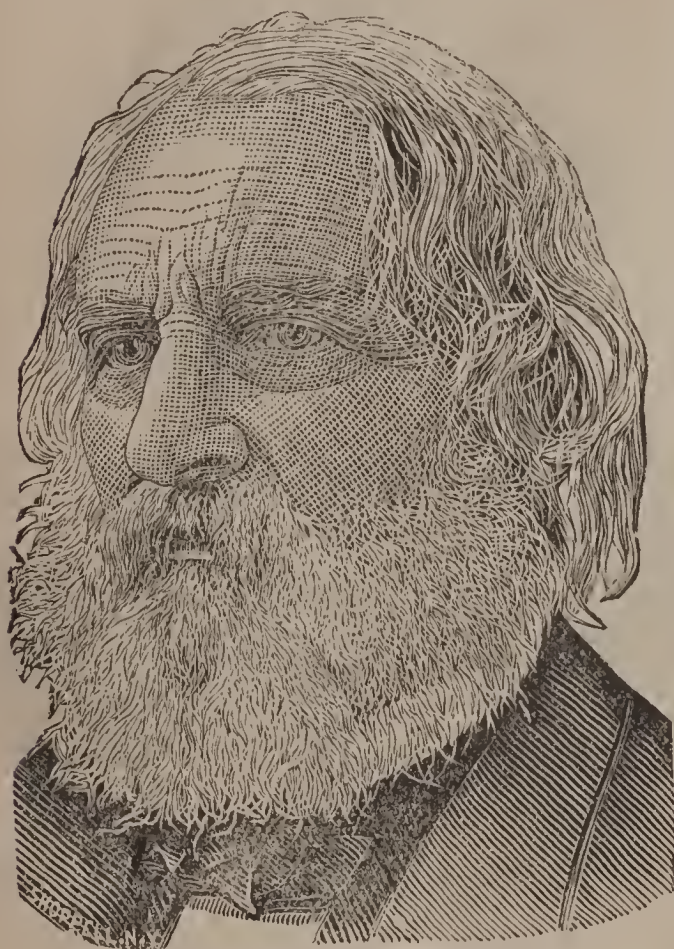


WILLIAM CULLEN BRYANT.

leading evening papers of the metropolis, which he conducted with rare ability. The first collected edition of his poems appeared in 1832. They were soon after republished in Great Britain, and were regarded as the highest efforts, up to that time, of the American Muse. In 1842 he published "The Fountain, and other Poems." Mr. Bryant visited Europe in 1834, and several times afterwards, and records his observations in "Letters of a Traveler in Europe and America." In 1853 appeared a new edition of his poetical works, and in 1869, a metrical translation of the "Iliad," followed in 1871 by that of "Odyssey." He afterwards engaged in writing a "History of the United States." He died June 12, 1878.

Henry Wadsworth Longfellow.—The subject of this sketch was the most popular of American poets. Mr. Longfellow was born at Portland, Maine, on the 27th of February, 1807. His father was an attorney at law. In 1821 he entered Bowdoin College, and was graduated therein four years later. He then read law a few months in his father's office, a pursuit which,

unhappily, he did not continue, friends who knew his genius, by acquaintance with his college life, providing him the opportunity of an occupation more congenial. They offered him the position of Professor of Modern Languages at Bowdoin, one entirely proper to his bent. To qualify himself the better for its duties, Mr. Longfellow spent the three years and a half immediately succeeding his acceptance of the offer, in Europe, visiting France, Spain, Italy, Germany, Holland and England for this purpose. He came home in 1829,

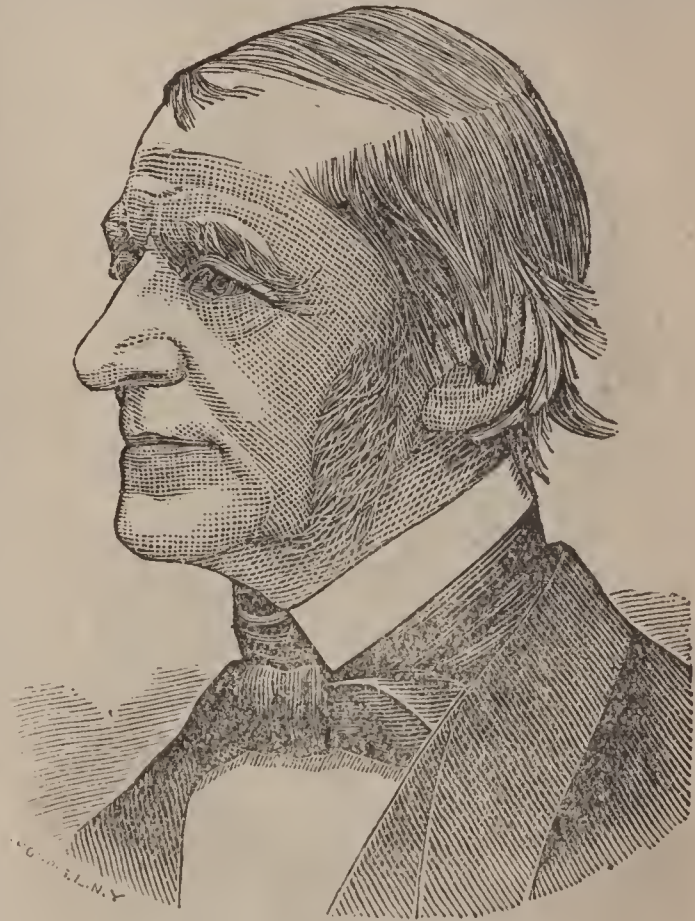


HENRY WADSWORTH LONGFELLOW.

and began his professorship at Bowdoin, which continued until 1835, when the death of Mr. George Ticknor, who held the corresponding position in Harvard University, resulted in his acceptance of the vacant professorship in that eminent seat of learning. Before actually entering upon its duties, he again went to Europe, this time visiting the Scandinavian countries, Germany and Switzerland, mainly with the view of promoting his acquaintance with the literature of Northern Europe. In the autumn of 1836, he began to teach in Harvard, and continued there eighteen years, when he was succeeded by James Russell Lowell. Mr. Longfellow's career as an author dated from his undergraduate days, during which he contributed poetry to the columns of *The United States Literary Gazette*. While at

Bowdoin some able pieces of literary criticism, the products of his fertile pen, were printed in *The North American Review*. His first volume of poems was published in 1833, and thereafter, at not infrequent intervals, a new volume appeared, always welcomed with pleasure by a large constituency of admiring, loving readers. There is no occasion whatever to detail the numerous productions of his pen. Perhaps "Evangeline" and "Miles Standish" are the best known of his longer pieces. In the writer's opinion, his most effective work is seen in some of his lyrics, which are perfect in their construction and pervaded with sweetness, pensive tenderness and humanity. They are carried in the memory of thousands on both sides of the Atlantic, and are gems which permanently enrich the literature of nations. Mr. Longfellow's poetry is not characterized by strength or greatness, but by gentleness, sweetness and refinement, the product of vast labor, but free from pedantry and affectation. He gave eloquent and simple voice to the convictions and emotions of good, every-day kind of people. He died March 24, 1882.

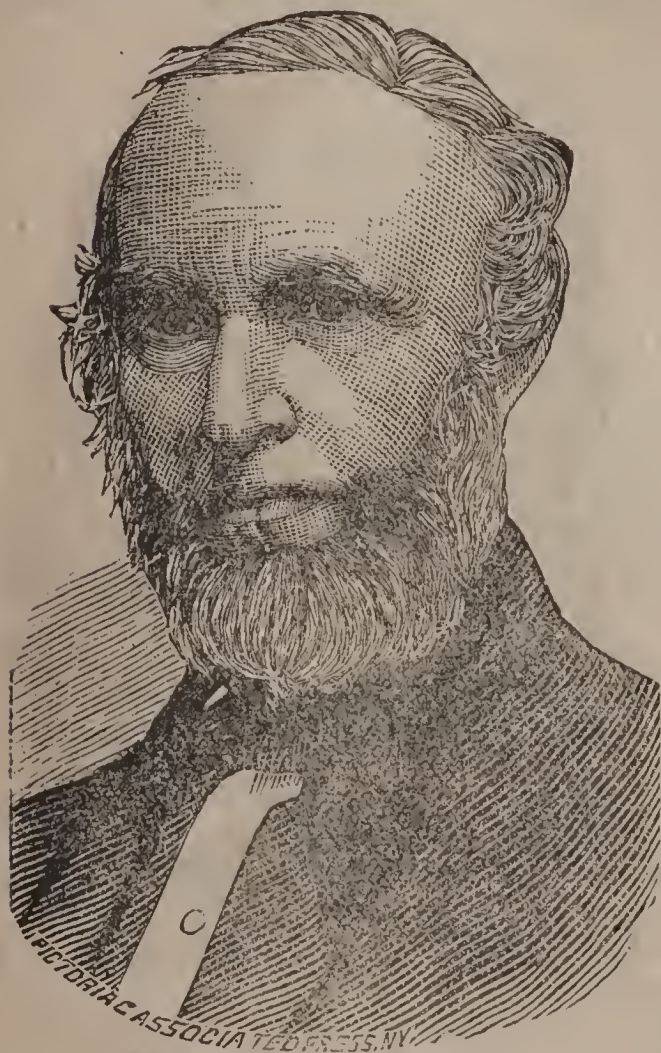
Ralph Waldo Emerson.—The famous “sage of Concord” was the son of a Unitarian minister. He was born in Boston, May 25, 1803. During the four years from 1817 to 1821, he studied at Harvard College, where he was graduated. It is told of him that he was not a model student, in the sense of superiority in the matter of performing set work, but he was a great reader and followed a decided personal judgment in his choice of books. Like many other great men, he started life as a teacher, which he did not follow long, but relinquished for the study of theology—an ancestral pursuit, by the way, for it is recorded that there was always a clergyman in the American branch of the family from the time when Concord was founded, back in the seventeenth century. For three years, from 1829 to 1832, he ministered thought to a congregation in Boston, but resigned when his people and he had grown hopelessly at variance in their conceptions of religion. Retiring to Concord, where he lived to the end, Mr. Emerson devoted himself to a life of letters, producing a considerable number of books in prose and poetry and lecturing in this country and abroad as solicited by demand for his utterances. He never cultivated popularity as a speaker, but his voice was, at one period of his life, heard frequently on the question of slavery, womens’ rights and other subjects of current and particular interest. Mr. Emerson made his first address as a literary man, in 1837, at Harvard, on “Man Thinking.” An address on “Literary Ethics,” to the Divinity School of the same University, was his next effort, delivered a year after the first. In 1840, he started a magazine called *The Dial*, which taught the “transcendental philosophy,” at that time greatly exercising the keen wits of New England. This publication lived four years. In 1841, Emerson published his “Method of Nature,” “Man the Reformer,” a volume of “Essays,” and several lectures. His first volume of poems appeared in 1846, in which year two series of “Essays” were also published. Three years after, he visited England, where he delivered a course of lectures on “Representative Men.” In 1852, associated with W. H. Channing and J. F. Clarke, he published a biography of Margaret Fuller, who, with A. Bronson Alcott, had assisted him in the conduct of *The Dial*. “English Traits,” perhaps the most read of his books, was published in 1856, and “The Conduct of Life,” in 1860. These are his principal works. Mr. Emerson’s style is peculiar, possessing affectations and conceits which mar the pleasure of



• RALPH WALDO EMERSON.

the average reader. His poetry is deeply tender and beautiful. He died April 27, 1882.

John G. Whittier.—John Greenleaf Whittier was born at Haverhill, Mass., in 1807. He is a descendant of a family belonging to the Society of Friends, with which Mr. Whittier is also connected, and from which fact he has gained the name of the "Quaker Poet." His earlier years were spent on his father's farm, and in the occupation of a shoemaker. A strong desire



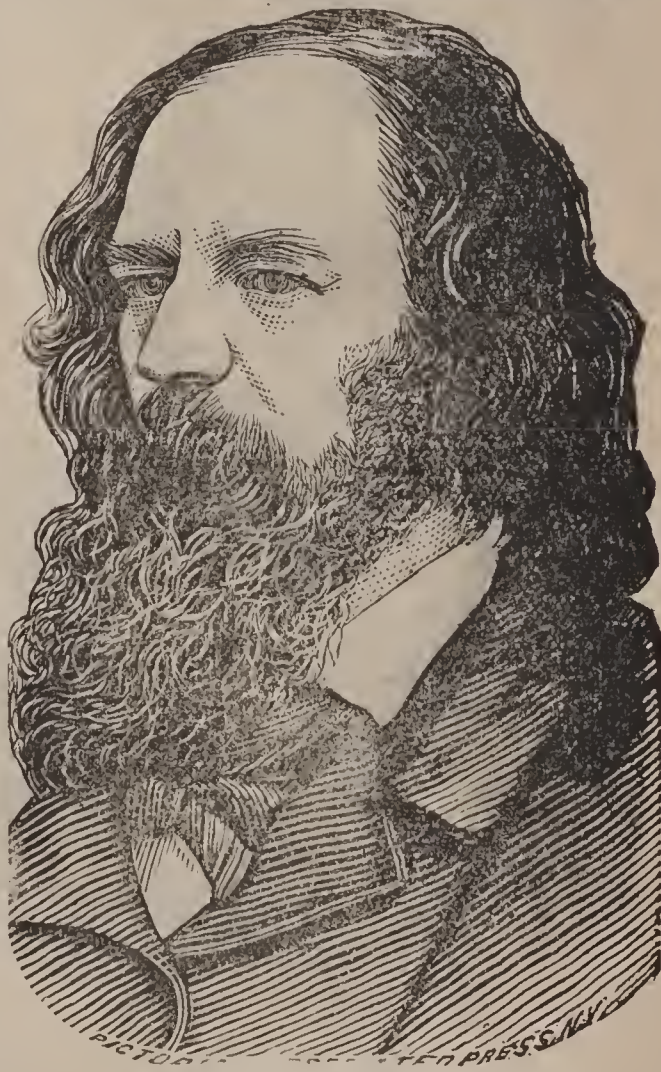
JOHN G. WHITTIER.

for learning led him to the local academy for a two years' course of study, and in 1829 he went to Boston and became the editor of the *American Manufacturer*, a protective tariff publication. In 1830 he edited the *New England Review*, at Hartford, Conn., from which place his first literary efforts were sent out. In 1835 and 1836 he represented his native town in the Massachusetts Legislature, and was one of the Secretaries of the American Anti-Slavery Society, and during the same years was editor of the *Pennsylvania Freeman*, in Philadelphia. In 1840, he removed to Amesbury, Mass., and employed a portion of his time as corresponding editor of the *National Era*, an anti-slavery paper, published at Washington, D. C. From that time until now, his life has been devoted to literature and philanthropy. His first venture, in a literary way, was published in the Newburyport *Free Press*, in 1826. He is a

prolific writer, and his prose has been widely circulated. He is a thorough American poet, selecting the home subjects, which find a welcome in every heart, and portraying with graphic word pictures the bright side of human life. There is never an exceptional line in Whittier's poems. They may lack the perfection of idea and expression which characterize the shorter lyrics of Longfellow; they may lack the humor of Holmes, and the polish of Tennyson, yet they have a quaint simplicity, which gives him an individuality entirely his own. The general impression of Whittier is one of simplicity and quiet quaintness, yet, at times, he bursts forth with a fire and energy which seem to spring from the intermingling of his very life-blood, the out-pouring of his soul, in his ardor and enthusiasm. Whittier may not be ranked by critics among the great poets of the world, but it is for but few to hold the love which he holds from the people of his native land.

Alfred Tennyson.—The Poet Laureate of England was born at Somersby, Lincolnshire, in the year 1809. He was the third son of the Rev. G. C. Tennyson, and nephew of the Right Hon. C. Tennyson d'Eyncourt. Trinity College, Cambridge, had the honor of being the place of education of the future poet. The story of Tennyson's life can be little else than the story of his successive poems. Bibliomaniacs are eager to give a high price for the little anonymous volume of "Poems by Two Brothers" (1827), the earliest published verses of Alfred and Charles Tennyson. In 1830 appeared

"Poems, Chiefly Lyrical," and from that date on Tennyson's fame as a poet grew rapidly. The "Mort d'Arthur," "Locksley Hall," the "May Queen," and "Two Voices" followed each other in quick succession. Of the "Idylls of the King," of which the "Mort d'Arthur" was the first, it may be said that while students of the old Welsh legends and of the ancient French Arthurian romances find much to cavil at, the general reader is introduced to a new and magical world of lofty thought and poetry. In 1847 was printed "The Princess," Tennyson's first long poem. "In Memoriam," the laureate's greatest poem, was suggested by the death of young Arthur Hallam. It is a series of marvelously touching monodies, is resplendent with religious and philosophical speculation, and was the work of many years. The death of Wordsworth (1850) left it almost a matter of course that to Tennyson should be offered "the laurel greener



ALFRED TENNYSON.

from the brows of him who uttered nothing base." Such noble poems as that on the death of the Prince Consort and the famous "Charge of the Light Brigade" show that the laureate did not consider his office an idle honor. Of Tennyson's other chief poems, "Maud" was printed in 1855; the first series of the "Idylls of the King" in 1859; "Enoch Arden and Other Poems" in 1864; "The Holy Grail and Other Poems" in 1869; a revised edition of the "Idylls," arranged in sequence, in 1870; and "The Widow" in the same year. His recent short poems—he now writes but little—are inferior to his best work. Like more than one great poet he has proved the delusiveness of the belief that a great poet must be also a great dramatist. "Queen Mary, a Drama" (1875), and "Harold" (1877), both tragedies in five acts, have some powerful passages, but as acting plays are dreary failures. Tennyson was married in 1851 to Miss Emily Sellwood. Before

that time he had lived chiefly in London; since he has resided at Farringford, Isle of Wight, at Aldworth in Surrey, and near Petersfield, Hampshire. He has two children.

Herbert Spencer.—The famous English evolutionist, Herbert Spencer, was born in Derby in 1820. He was educated by his father, W. G. Spencer, a teacher, chiefly of mathematics, and his uncle, the Rev. Thomas Spencer, a clergyman of the established church, well-known for his liberal



HERBERT SPENCER.

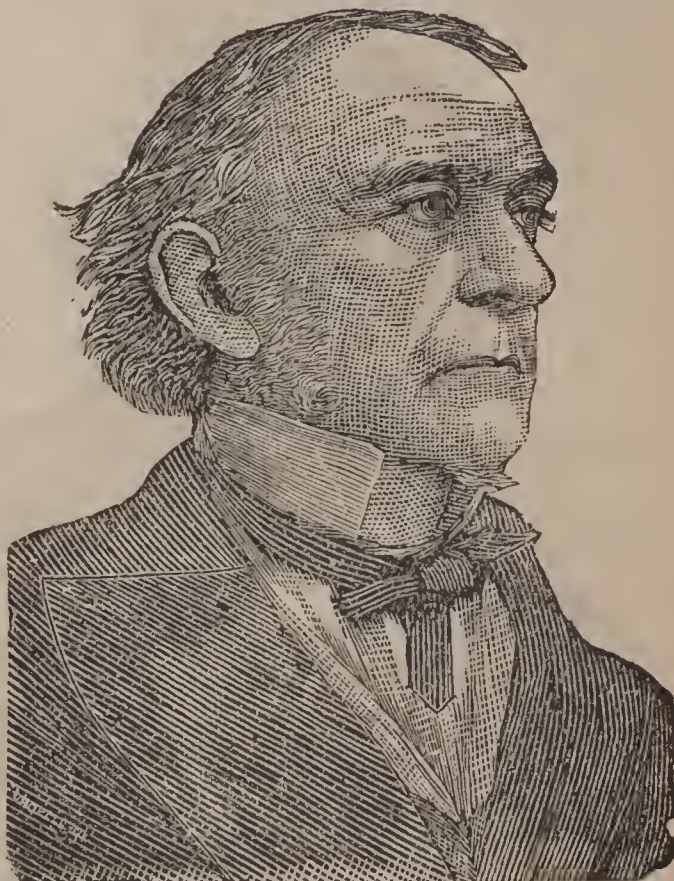
opinions on political and ecclesiastical questions. At the age of seventeen, he became a civil engineer; but after about eight years, abandoned the profession, in consequence of the large influx of young men brought into it during the railway mania, and the consequent undue competition. During the eight years of his engineering life, he contributed various papers to the *Civil Engineer's and Architect's Journal*. His first productions in general literature were in the shape of a series of letters on the "Proper Sphere of Government," published in the *Nonconformist* newspaper in 1842, which were some time after reprinted as a pamphlet. From the close of 1848 to the middle of 1853, he was engaged on the *Economist*, then edited by the late James Wilson, M. P.; and during

this time he published his first considerable work, "Social Statics." Shortly afterward he began to write for the quarterly reviews, most of his articles appearing in the *Westminster*, and others in the *North British*, *British Quarterly*, *Edinburgh*, *Medico-chirurgical*, etc. In 1855, appeared his "Principles of Psychology." In 1860 he commenced a connected series of philosophical works, designed to unfold in their natural order the principles of biology, psychology, sociology and morality. To this series belong, besides the "Psychology" (2 vols., new edition 1871—1872), "First Principles" (1862, second edition, 1867); "Principles of Biology" (two vols., 1864), and "Principles of Sociology" (first vol., 1876). "Education" was published in 1861; "The Study of Sociology" in 1872; and "Descriptive Sociology" in 1873. Spencer has applied universally, and carried out into detail, the theory of evolution.

William E. Gladstone.—An outline of the public career of William E. Gladstone, Prime Minister of England, is soon given, although he has

assisted in the making of history for nearly half a century, and is, in some respects, the most remarkable, if not the greatest, man in Europe. He was born December 29, 1809, at Liverpool, an Englishman by birth, but Scotch in blood. His father was a merchant of considerable eminence and wealth. Great pains were taken in the education of a lad singularly studious and ambitious. Before attaining the age of twenty-two, the future statesman graduated at the University of Oxford. This was in the year 1831, preceding by a twelve-month only his entrance upon public life as member of Parliament for Newark-on-Trent.

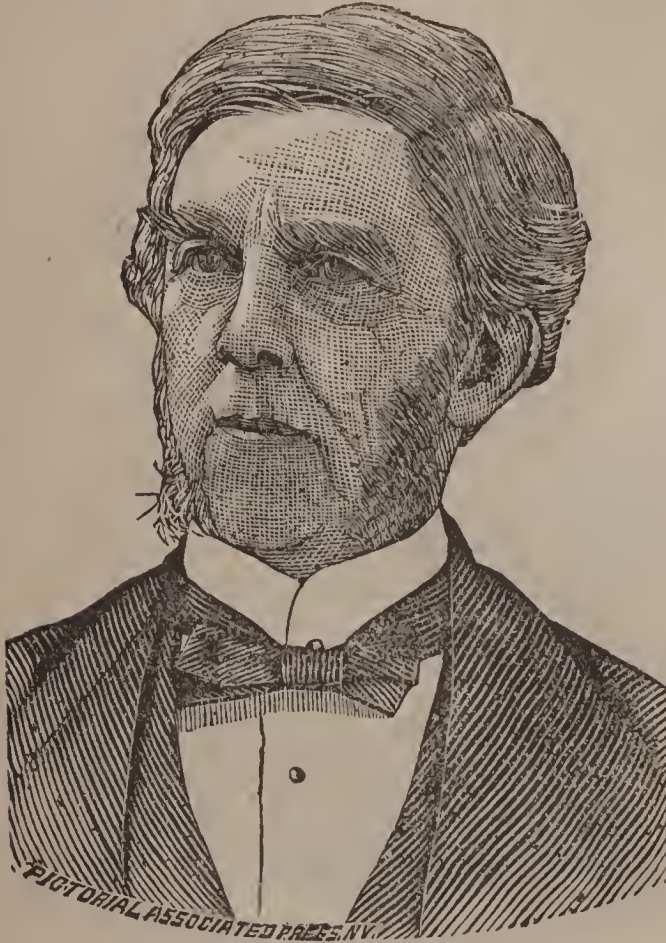
Gladstone was an ardent Conservative at that time, and his first book was a defence of the union of Church and State—a remarkable work which Macaulay reviewed in the *Edinburgh Review*, with appreciation of its spirit and scholarly style, but condemning its conclusion. Newark continued Mr. Gladstone as her representative until 1845. During the thirteen years of this association, hopeful honors had fallen on the head of the youthful Commoner, “handsome Gladstone,” as he was called. He was only twenty-five when Sir Robert Peel made him a Junior Lord of the Treasury. Three months later, he was promoted to be an Under Secretary for the Colonies, which position he held until April, 1835, when Peel went



WILLIAM E. GLADSTONE.

out of office. Upon the return of Sir Robert to power, in 1841, Mr. Gladstone was made Vice-President of the Council and Master of the Mint. In 1843, he relinquished the first-named of these offices in order to assume that of President of the Board of Trade. Two years afterward he was made Secretary for the Colonies. In 1851 Mr. Gladstone differed so widely from his party in opinion, that he was no longer numbered in the Conservative ranks. He was a member of the coalition ministry of Lord Aberdeen formed in the year 1852, that same ministry which, in alliance with France and Turkey, undertook the war with Russia. His office was that of Chancellor of the Exchequer, for which he showed a marvelous aptitude. In 1858 and 1859 the subject of this sketch was sent on a special mission to the Ionian Islands, and in June, 1859, again served as Chancellor of the Exchequer under Lord Palmerston, the Premier, upon whose death and the succeeding premiership of Earl Russell he continued to hold the same position, and also acted as leader of the House of Commons. In 1866 the Russell-Gladstone ministry, as it was called, resigned in consequence of an adverse vote on the question of reform in Parliamentary representation, and a Conservative government assumed office. In 1868, Mr. Disraeli's government retiring

because of the election of a Liberal majority to the Commons, Mr. Gladstone assumed the premiership for the first time. His great measures, the disestablishment and disendowment of the Irish Church and the Irish Land Bill, were passed by the year 1870. In 1873, his government was defeated on the Irish University-Education Bill, and he resigned, but was persuaded by his sovereign to resume office. He served until after the general election of 1874, which resulted in the triumph of the Conservatives. Mr. Gladstone now retired from the leadership of his party in the House of Commons, which was assumed by the Marquis of Hartington, and devoted himself to literary labor. The magnificent triumph of the Liberals in the election of 1880, when Mr. Gladstone was elected by Mid-Lothian and the borough of Leeds, virtually compelled his assumption of power as the First Lord of the Treasury, to which he added the functions of Chancellor of the Exchequer.



OLIVER WENDELL HOLMES.

Oliver Wendell Holmes.—This famous poet and humorist was born in 1809, in the old "gambrel roofed" house in Cambridge, Mass., opposite the Harvard University buildings. His father, Rev. Abiel Holmes, D. D., was an eminent preacher, and was long pastor of the First Congregational Church of Cambridge. Dr. Holmes graduated at Harvard in 1829, and, adopting the

medical profession, completed his studies in 1836. Up to 1847 he filled the chair of Anatomy and Physiology at Dartmouth, and in the latter year assumed a similar professorship at Harvard, since which he has resided continuously in Boston. It would be difficult to say whether Dr. Holmes enjoys greater distinction as a physician or man of letters. Both in the theory and practice of medicine, he has achieved the most brilliant success. He has especially devoted himself to the investigation of psychological problems, raised by the interdependence of mind and matter, a romance, "Elsie Venner," dealing with this subject. The success of the *Atlantic Monthly* was largely due to his "Autoerast of the Breakfast Table" and other prose pieces which he contributed. His graceful and polished style invests the driest topics with a peculiar charm, and makes him one of the best known and most popular of American writers. Who has not heard of the "One Horse Shay"? Though past the allotted three-score and ten years, he is still hale and hearty, looking as he has for forty years past. Shrewd, observant, reflective, humorous, generous, kindly and tender, he is

one of those to whom any one could come for help. A genial and cheery temperament has made him the idol of the Harvard medical students whom he has so long instructed. No man in America is held in higher honor than Oliver Wendell Holmes, whose name is an ornament to American literature as well as to the medical profession.

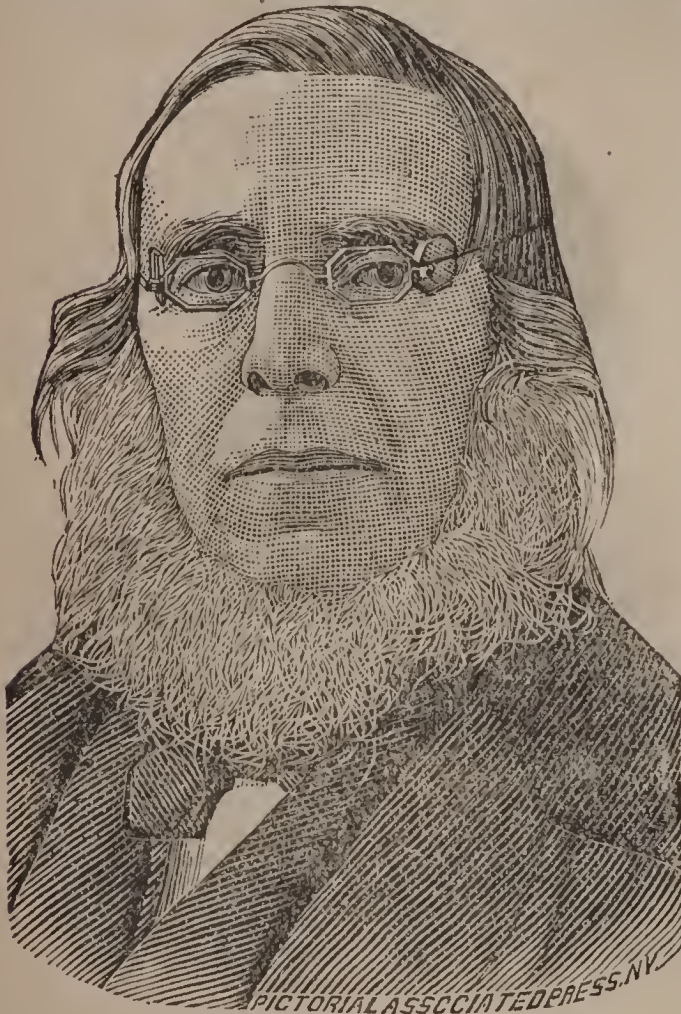
James Russell Lowell.—Mr. Lowell is descended from an English family who settled in New England in the year 1639. His grandfather was made a Judge by Washington after having assisted in framing the Constitution of Massachusetts in 1780, moved the insertion in the Bill of Rights of that State of the clause that "all men are born free and equal," and earned great eminence as a lawyer. The family of the Lowells gave its name to the city of Lowell, and has given merchants, manufacturers, authors, preachers, lawyers, scholars, philanthropists and statesmen to the Bay State. Mr. Lowell was born at Cambridge, Mass., February 22, 1819. He was educated at Harvard, and in 1855 succeeded Mr. Longfellow in the Belles-Lettres professorship of that college. One of his greatest literary performances was the production of the "Biglow Papers." He is the author of several long poems which are ranked with our best literature, and of shorter pieces almost innumerable. He is a graceful speaker, and is remarkable for the polish of his utterances whether by pen or voice. He has force and the courage of his opinions, which were decidedly on the side of freedom in the anti-slavery agitation, but is not an aggressive man, and treats his opponents with self-restraint, courtesy, and the quiet dignity of the scholar and gentleman. His first diplomatic position was that of Minister to Spain, and his last appointment as Minister to England was conferred upon him by President Hayes.



JAMES RUSSELL LOWELL.

Peter Cooper.—No man was more honored and loved than the venerable Peter Cooper, whose death in 1883 was mourned as a public loss. Mr. Cooper was born in New York City, February 12, 1791. His father served as a Lieutenant in the Revolution, after which he established a hat factory, where young Peter worked. In 1808 he was apprenticed to a coachmaker, who esteemed him so highly that he offered to start him in business, which was declined. Young Peter was able to attend school but half of each day for a single year. From 1812 to 1815, he manufactured a patent machine for

shearing wool, which was in great demand, but lost its value on the conclusion of peace. He successively engaged in the manufacture of cabinet ware, the grocery business and in the manufacture of glue and isinglass, which last he continued for more than forty years. The success which everywhere crowned his efforts he attributed to his never incurring a debt, and so never having interest to pay. His policy was never to owe any man anything except his good will. He built iron works near Baltimore in 1830, and turned out the first locomotive engine in America. Selling this soon



PETER COOPER.

after he erected a rolling and wire mill, in which anthracite coal was first successfully applied to puddling iron. In 1845, he erected at Trenton, New Jersey, the largest mills then in the United States for the manufacture of railroad iron. Here, he was the first to roll iron beams for building purposes. He invested a large capital in extending the electric telegraph, and advocated the construction of the Croton Aqueduct, New York. The Erie Canal project received his hearty support, and he invented an endless chain operated by water, which in trial propelled a boat two miles in eleven minutes. But his chief title to fame rests upon his efforts in behalf of popular education. He was Vice-President of the old Public School Society, when it was merged in the Board of Education.

To give the masses the

benefits of the School of Technology he established in New York, in 1858, the Cooper Union for the Advancement of Science and Art. The building covers the block between Seventh and Eighth Streets and Third and Fourth Avenues, and cost \$2,000,000. To this he added an endowment of \$150,000 in cash, and other gifts. His career shows him to have been one of the greatest of Americans and the noblest of men. He learned three trades before he was twenty-one; his genius enabled him to rank high as an inventor; he was pre-eminently a man of affairs, his knowledge of men and business securing success in every venture; and most important of all, he was a broad and practical philanthropist, who labored constantly for the elevation and advancement of the masses of the people. His son, Edward Cooper, was at one time Mayor of New York, and a daughter is the wife of the Hon. Abram S. Hewitt, for many years a member of Congress from New York.

James A. Garfield.—The twentieth President of the United States, James A. Garfield, was born in a log cabin in Orange township, Cuyahoga County, Ohio, November 19, 1831. His early education was obtained at a district school-house, where he learned to read, write and cipher. At the age of eighteen he went to Newburgh and chopped one hundred cords of wood for fifty dollars. He then hired out to drive horses on the canal. The following year he went to Geauga Academy, to make a beginning toward getting an education. In the summer he worked for day wages as a farm hand and at the carpenter's trade, and in the winter studied industriously and lived economically. From the Geauga Academy he went to the Eclectic Institute at Hiram, Ohio, where he paid for his tuition by teaching country schools in winter. In 1854 he entered Williams College, at Williamstown, Mass., and after graduating there he became professor of Latin and Greek and afterward President of the Hiram Institute. He now began to take part in politics, and early espoused the cause of the Republican party. He was elected to the State Senate of Ohio in 1859, and afterward studying law, was admitted to the bar in 1861. In the same year the civil war broke out, and Garfield was an early volunteer. He served with distinction under Buell and Rosecrans at Shiloh, Chickamauga and in other important engagements, being promoted successively to the ranks of Lieutenant-Colonel, Colonel, Brigadier-General and Major-General. In 1862 he resigned his commission to accept a nomination for Congress. He served in the House for nearly twenty years, and became recognized as one of the ablest leaders of his party. In January, 1880, he was elected to the United States Senate, and in June of the same year he was nominated by the Republican party as its candidate for President, to which high office he was triumphantly elected in the fall of that year. His administration opened most conspicuously, but on the 2d of July, 1881, he was assassinated by one Charles J. Guiteau, probably from motives of revenge, he having failed to obtain from the President a coveted foreign mission. After a long and painful illness Mr. Garfield died at Long Branch, N. J., September 19, 1881.



JAMES A. GARFIELD.

Ulysses S. Grant.—This famous General and the eighteenth President of the United States, was born at Point Pleasant, Clermont County, Ohio, April 27, 1822. He graduated at the Military Academy of West Point in 1843, and served under General Taylor in the war with Mexico, in 1846, up to the capture of Monterey. His regiment was then transferred to the

expedition under General Scott, and he took part in every action from Vera Cruz to Mexico, and was brevetted First Lieutenant and Captain for meritorious conduct at Molino del Rey and Chapultapec. In 1852, he served in Oregon; but, in 1854, resigned his commission, and settled at St. Louis, Mo., whence, in 1859, he moved to Galena, Ill., and engaged in the leather trade. At the beginning of the War of Secession in 1861, he volunteered his services,



ULYSSES S. GRANT.

and was appointed Colonel of an Illinois regiment. In August he was appointed Brigadier-General, commanding the important post of Cairo, occupied Paducah, and led an expedition on the Mississippi. In February, 1862, he distinguished himself in the capture of Fort Donelson, on the Tennessee River, and was made Major-General. On the 6th of April following, after a preliminary defeat, he won a great battle over the Confederates at Pittsburgh Landing, or Shiloh. Succeeding General Halleck in the west, he commanded the land forces which, in conjunction with the navy, reduced Vicksburg, July 4, 1863, soon followed by the fall of Fort Hudson, and the opening of the Mississippi. He then took command of the Army of the Tennessee, and defeated General Bragg at Chickamauga, in September of the same year; and was, in 1864, appointed Lieutenant-General and Commander-in-Chief, and personally directed the operations of the great

final struggle in Virginia, in which the Northern forces, though often repulsed with heavy losses, finally compelled the evacuation of Richmond, April 2, 1865, followed on the 9th by the surrender of the Confederate army under General Lee, and soon after of the entire Confederate forces. Congress, in recognition of his eminent services, passed an act reviving the grade of "General of the Army of the United States," to which Grant was immediately appointed. In 1868 he was elected, on the Republican platform, President of the United States; and having, in 1872, been re-elected over a notable opponent, the late Horace Greeley, of the *New York Tribune*, he retired in 1877 after his second term of office. In the latter year he began his tour around the world, returning in 1880, after having been the recipient of unprecedented honors. In 1885, he completed his popular work, "The Personal Memoirs of U. S. Grant," being a narrative of his own experiences during the war of the Rebellion. He died July 23, 1885.

Samuel J. Tilden.—The distinguished Democrat, Samuel J. Tilden, was born in New York City in the year 1814. He entered Yale College, from whence he was graduated. Choosing the legal profession he subsequently studied law in the University of New York, and was admitted to the bar. His advancement, owing to his extraordinary natural gifts, was rapid, and he soon acquired a reputation for great legal acuteness, especially in railroad litigation. He soon became interested in local and State politics, and was for thirteen years Chairman of the Democratic State Committee of New York. He was elected to the Legislature in 1846, and in 1872 this honor was again conferred upon him. Meantime he had acquired great wealth from the practice of his profession and many shrewd speculations and investments, being one of the leading capitalists engaged in building the elevated railroads in New York City. In 1874 Mr. Tilden received the nomination for Governor of the State of New York, to which office he was elected. During the two years in which he was at the head of the State Government he achieved great reputation as a reformer, breaking up numerous corrupt rings, and became at once the most prominent man in his party. He was nominated for the Presidency in 1876, Mr. Hendricks, of Indiana, being the candidate for Vice-President. In the election which followed Mr. Tilden received a majority of the popular vote, and on the face of the returns was duly elected. A dispute arose, however, regarding the vote in the States of South Carolina, Louisiana, Florida and Oregon, and a commission consisting of five Senators, five Judges of the Supreme Court and five Members of the House of Representatives, was appointed to determine the matter. This commission was composed of eight Republican and seven Democratic members, and, dividing strictly upon party lines, gave the electoral votes of the disputed States to Rutherford B. Hayes, Mr. Tilden's opponent, who was accordingly declared elected. Though frequently urged to again become the standard bearer of his party, Mr. Tilden has mingled no more in politics, but has lived in retirement at his palatial residence in Yonkers, N. Y.



SAMUEL J. TILDEN.

George F. Edmunds.—Senator Edmunds is descended from Quaker and Puritanic parentage. He is a Vermonter by birth, having been born at Richmond, February 1, 1828. He received a public school education, read

George F. Edmunds.—Senator Edmunds is descended from Quaker and Puritanic parentage. He is a Vermonter by birth, having been born at Richmond, February 1, 1828. He received a public school education, read

law and was admitted to the bar. At twenty-six years of age, he was elected to the State Legislature, and continued to assist in its proceedings five years, during three of which he served as Speaker of the House. In 1861 and 1862, he acted as temporary presiding officer in the Senate of Vermont. His seat in the United States Senate has been held continuously since 1866, when he received an appointment to fill the vacancy created by the death of Solomon Foot. He was a member of the Electoral Commission in 1877, and



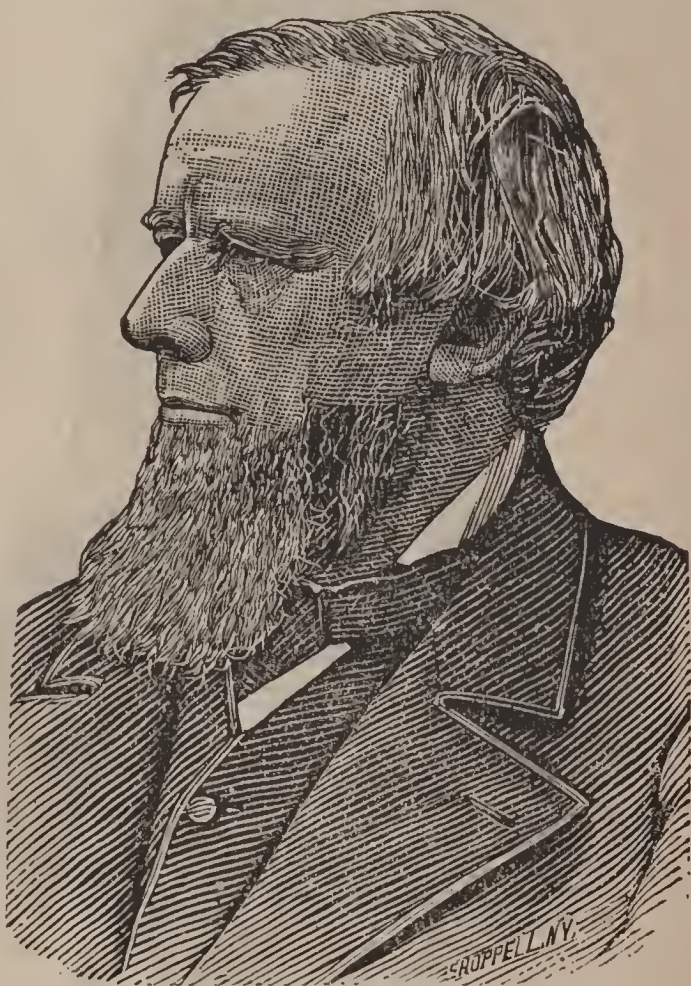
GEORGE F. EDMUNDS.

succeeded Mr. Trumbull in the Chairmanship of the Judiciary Committee. In that position some of the most important measures ever before the National Legislature passed through his hands. He is an able, but not a brilliant speaker, and however keen and sarcastic his oratorical efforts may be, he is never personally offensive. As a lawyer, statesman and debater, Senator Edmunds ranks among the highest. The country hears from him on all great public questions, which do not seem to have been thoroughly discussed until the illumination of his learning, cool judgment and perspicuous statement have been brought to bear upon them. He is emphatically a safe man. While staunch to his party, he is not narrow or unfair, and is regarded by the opposite party with a respect as nearly like the veneration with which his own party regards him, as the circumstances of political opposition admits of. He is a

genial man, warm and constant in his friendships, as witness his longtime brotherly association with Senator Thurman, with whom he was inseparable, excepting in the Senate where party lines divided them. That he is a good man, against whose fair name calumny would be powerless, needs not to be said. In 1880 several leading newspapers strongly urged his nomination for the Presidency. Mr. Edmunds is a tall, broad shouldered man with a stoop noticeable in close students. His eyes are steel gray set under heavy eyebrows of bristling white. No public man is more respected. His honors are universally felt to be due to his superior talents, exemplary diligence and exalted character.

Allen G. Thurman.—Ex-Senator Allen G. Thurman, of Ohio, a gentleman held in the highest esteem by both political parties, and a statesman of learning, experience and lofty character, is a native of the State of Vir-

ginia. He was born at Lynchburg, November 13, 1813. When four years old his home was changed to the State of Ohio. He received a thorough education, studied law, and was admitted to the bar when twenty-two years of age. After having practiced law for some years at Columbus, Ohio, he was returned as Representative to the Twenty-ninth Congress. In 1851 he was elected a Judge of the Supreme Court of Ohio, and was Chief Justice in the same court from 1854 to 1856. He was the Democratic candidate for the Governorship of the State in 1867, but was defeated. A year later he was elected a United States Senator, and took his seat March 4, 1869. He was re-elected in 1874, and his second term of service expired March 3, 1881, when, the Legislature of Ohio being Republican, he retired to private life in his home at Columbus. Mr. Thurman's services to his party, as well as to the country at large, are well known. In the Senate he was a warm and vigorous advocate of all just and prudent measures, and a bitter antagonist of corruption. He is one of the few public men who possess the confidence and esteem of the entire people, even those differing with him upon questions of political economy cheerfully acknowledging his remarkable abilities and sterling integrity. He has long been upon terms of warm intimacy with Senator Edmunds, of Vermont, though the two are widely at variance in political views. He was prominently mentioned as the Democratic candidate for President in 1880 and again in 1884, and, though Allen G. Thurman may or may not be again called upon to serve the country in office, he will always hold a high place in the esteem of his countrymen.



ALLEN G. THURMAN.

John Sherman.—His record gives the subject of this sketch great authority on the question of finance. He is an Ohio man, born at Lancaster on the 10th of May, 1823, in a family of English extraction, whose first American ancestry settled in Connecticut and Massachusetts. His father, Charles Robert Sherman, was made a Judge of the Supreme Court of Ohio, the same year in which John was born, the eighth child of a family of twelve. When his father died, John was only six years old, and the widow's eleven surviving children were divided by harsh necessity, only three being left in their mother's care. In 1831, John was taken by a cousin of his father,

named John Sherman, to live with him at Mount Vernon. This kinsman had him thoroughly prepared for the academy in anticipation of giving him a college education. At twelve, young John entered the Academy at Lancaster. We next find him acting as junior rod man in a corps of engineers engaged in the Muskingum improvement. In 1838, when only fifteen, he was given charge of the works at Beverly. His next move was to study law in the office of Charles T. Sherman, an older brother, who was afterwards



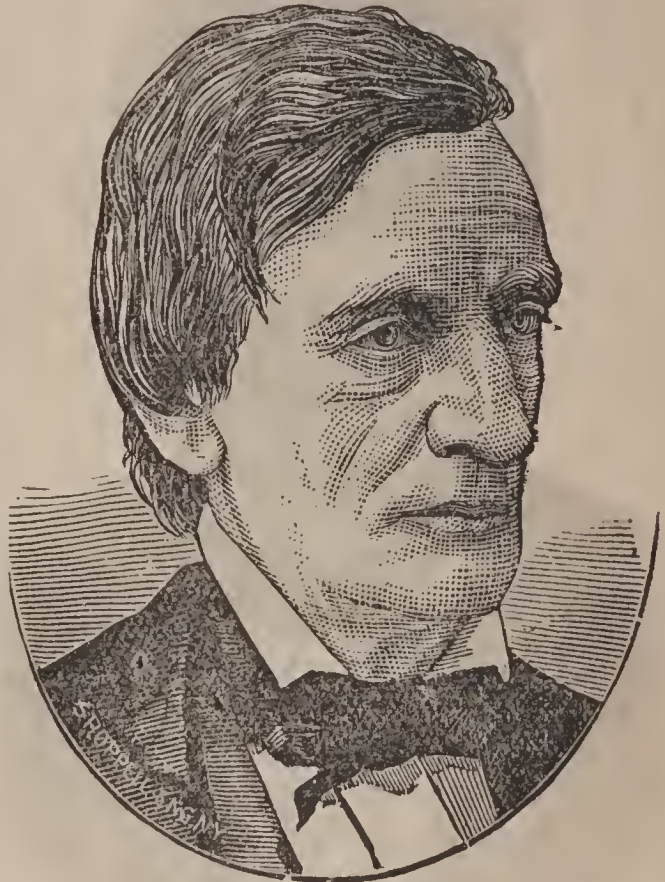
JOHN SHERMAN.

made a Judge of the United States District Court. He entered into partnership with his brother at Mansfield in 1844. Four years later, he began his political life as delegate to the Whig Convention which nominated General Taylor for President. In the same year, 1848, he married a daughter of Judge Stewart, of Mansfield. He was delegate to the Baltimore Convention of 1852, which nominated General Scott. His first election to Congress was in 1855, where he gained distinction in committee work. He was a supporter of John C. Fremont, in 1856, believing that the area of slavery should not be extended while the existence of the institution itself could not be disturbed in the States which supported it. Mr. Sherman was elected to the Thirty-fifth and Thirty-sixth Congresses. When, in March, 1861, Salmon P. Chase retired from the Senate, John Sherman was elected to take his place, and was re-elected

in 1867 and 1873. He was conspicuous for patriotism in the war, spending money, time and service in the Federal cause. The making Treasury notes a legal tender in 1862 was mainly due to him and Salmon P. Chase. In 1867, he proposed the Refunding Act, passed in 1870, and the resumption of specie payments on January 1, 1879, was the leading triumph of his financial policy. President Hayes made him Secretary of the Treasury in March, 1877. Upon retirement from office with the incumbency of President Garfield, the veteran financier resumed his seat in the United States Senate.

William M. Evarts.—Both as a lawyer and a statesman Mr. Evarts ranks high. Since the death of Charles O'Connor he has been regarded as at the head of the American Bar. His career in his profession has been one of unfailing diligence and brilliant success. The firm of which he is now the

head is entrusted with great interests, and realizes enormous fees. As a matter of course, opinions differ strongly as to Mr. Evarts's political views and conduct. He was born in Boston, February 6, 1818, the son of a clergyman of that city. When a child he manifested wonderful precocity, and was well grounded in the learned languages very early in life. He is a graduate of Yale, and of Harvard in law. In 1841 he was admitted to the Bar in New York City, where he continues in active practice. Mr. Evarts was leading counsel for President Johnson in the impeachment proceedings of 1868, and from July 15 of that year to the end of the Johnson administration was Attorney-General of the United States. He represented the United States in the tribunal of arbitration which determined on the Alabama Claims at Geneva in 1872. Mr. Evarts was chief of counsel for Henry Ward Beecher in the Tilton-Beecher trial. In 1876 he was appointed by Governor Tilden to serve on the Charter Commission. He was Secretary of State during the administration of President Hayes, after having represented the Republican party in the discussion, before the Electoral Commission, of the questions on which the Presidency depended. In 1885 he was elected to the United States Senate. Perhaps no man is better qualified than Mr. Evarts to speak on questions of interest at public meetings, and he is much in demand on these occasions. He is believed to be unequalled as a phrase-maker, and seems to be able to talk happily under all circumstances. Unfortunately his delivery, graceful and correct as it is, is unaccompanied by the power necessary to its perfection. Notwithstanding this defect, however, no public man in the United States is heard with greater respect and admiration than Mr. Evarts. He is accused of time-serving, a want of moral courage, and inconsistency in his utterances, but a man who has talked so many years can hardly be expected to remain in the same mind on every question which has engaged his attention. Mr. Evarts's personal appearance is remarkable. He is tall and thin. His face is refined and indicative of his extraordinary capacity, but cold and unvarying in its expression. The great lawyer and rhetorician, "the American Cicero," as somebody calls him, dresses most ungracefully; but too much hat and baggy trousers do not impair the certainty of his being recognized as a gentleman by all sorts and conditions of people. He is a family man, the head of a household eminent among the most refined and cultured in New York.



WILLIAM M. EVARTS.

Thomas F. Bayard.—Thomas Francis Bayard was born in Wilmington, Del., October 29, 1828. His father and grandfather, both named James A. Bayard, and his uncle, Richard H. Bayard, served as United States Senators from Delaware. Mr. Bayard was educated chiefly at the Flushing school established by Rev. Francis L. Hawks, D. D., and was originally designed for a mercantile career. He chose the law, however, and was admitted to the Bar in 1851. He was appointed United States District-Attorney for Delaware in 1853. He succeeded his father in the United States Senate, taking his seat on March 4, 1869, and was re-elected in 1875



THOMAS F. BAYARD.

and 1881. In 1876 he was a Member of the Electoral Commission. During his career in the United States Senate he distinguished himself in all the ways by which a public official could commend himself, and it is presuming nothing to say that he is among the foremost of American statesmen to-day. He has brought to his work high personal character, a mind of conservative mold, pure devotion to great public interests, ability as an orator and debater and activity and energy in the committee room—qualities that have never failed him. He has always been an unquestioned Democrat, respected by his party as a great and safe leader, although hardly ever the beau ideal of the mere machine politicians. In person he

bears an admirable physique; is fond of outdoor sports and athletic exercise. He is married, and is the head of an interesting family. In the Democratic National Convention of 1880 he received 153½ votes on the first ballot. In the Democratic National Convention of 1884 he received 170 votes on the first ballot and 151½ on the second. In 1885 he was appointed Secretary of State by President Cleveland.

James G. Blaine.—This distinguished gentleman, who is universally known as a statesman of large views and varied attainments, comes of good old Revolutionary stock, and was born in Union Township, Washington County, Pennsylvania, in 1830. When but seventeen years of age, he was graduated with the first honors of his class from the College of Washington and Jefferson, in that State. Shortly afterward he went to Kentucky and entered upon the active business of life, by becoming Professor of Mathematics in the Western Military Institute, at Blue Lick Spring. During his residence there, he first met Miss Harriet Stanwood, an accomplished young lady from Maine, who, after he had had experience as a tutor for two years,

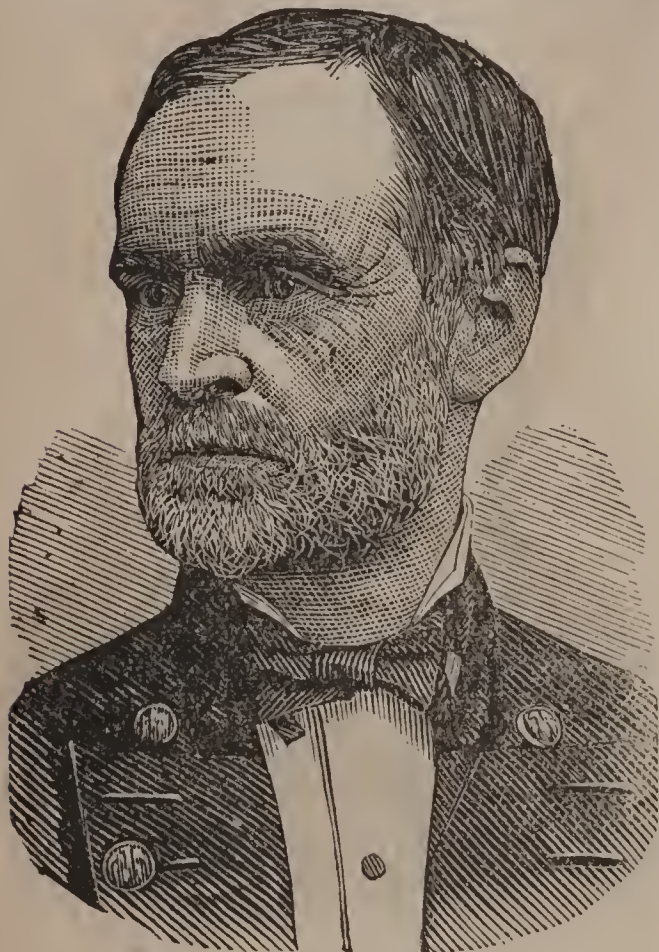
induced him to remove to her native State, where he soon began to display those abilities which have since made him famous, and which have for years placed the leadership of the Republican party of that section of the Union in his hands. Soon after his arrival in Maine, he married the lady just mentioned; and not long subsequently embraced the profession of journalism, becoming, for a brief period, connected with the *Portland Daily Advertiser*. Upon relinquishing his position on this publication, he settled in Augusta, and undertook the editorship of the *Kennebec Journal*; thenceforward progressing steadily in both private and public estimation. In 1858, Mr. Blaine was elected a Representative of the Republican party to the State Legislature, where he speedily made his mark. From this time forward his influence in the House and throughout the State became most pronounced, and so well assured, that he was called upon to serve for four sessions, during the latter two of which he was Speaker of the House. In 1862 he was first elected to Congress, and was re-elected six times, or until he became a Senator in 1876. He was Speaker of the Forty-first, Forty-second and Forty-third Congresses, and was still serving his first term as Senator when he was appointed Secretary of State by President Garfield in 1881. Upon the death of Mr. Garfield, which occurred in September of the same year, Mr. Blaine retired to private life and engaged in writing a voluminous work entitled "Twenty Years of Congress." The first volume was published in 1884, and met with an almost unprecedented success. In June of the same year the Republican National Convention met at Chicago and nominated Mr. Blaine for the Presidency. He directed a vigorous campaign, but was defeated by his Democratic opponent, Grover Cleveland.



JAMES G. BLAINE.

William T. Sherman.—General Sherman is a native of the State of Ohio, and was born at Lancaster, on the 8th of February, 1820. He was graduated at West Point in his twenty-first year, and saw military service in Florida and the war with Mexico and elsewhere, before resigning his commission in the year 1853. Upon his retirement from the army he began business in San Francisco as a banker, and continued this vocation four years, including a residence in New York City. From 1857 to 1859 he practiced law in Leavenworth, Kansas. During the succeeding time up to the secession of the State from the Union, he acted as Superintendent of the Louisiana Military Academy. His resignation took place in January, 1861,

and was almost immediately followed by his return to the army. The civil war gave Sherman the opportunity of distinguished service, and placed him in the first rank of living generals. His first commission was that of Colonel of a regiment of infantry. At the battle of Bull Run he commanded a brigade of volunteers, and was made Brigadier-General of volunteers. After serving a short time in the camp of instruction at St. Louis, he took part in the campaign conducted in the States of Tennessee and Mississippi, during which he was promoted to the rank of Brigadier-General of the



WILLIAM T. SHERMAN.

regular army. In October, 1863, he succeeded General Grant as commander of the army department of the Tennessee. When, in March, 1864, General Grant was made Lieutenant-General and Commander of all the Union forces, Sherman succeeded him as Commander of the military division of the Mississippi. This included the entire Southwest, and his appointment gave him command of more than a hundred thousand effective troops with whom to operate against General J. E. Johnston. He began the invasion of Georgia on the 2d of May, 1864, making his advance movement at the same time with that of General Grant in the East. His forces were superior in number to those of the Confederate General, who, however, stubbornly contested the advance at every possible point. There was much hard fighting be-

tween the two armies, and it was not until September 2d that Atlanta was captured by Major-General Sherman, but then newly promoted to this rank. He occupied the city with his army for ten weeks, when he commenced his march to the sea, having previously dispatched some forty thousand men under General Thomas to repel General Hood's advance into Tennessee. His remaining forces consisted of sixty thousand men, more or less. In less than a month they had marched three hundred miles without resistance. His first fight was at Fort McAllister, below Savannah, the surrender of which stronghold preceded that of Savannah by eight days. In the middle of January, 1865, General Sherman began his invasion of the Carolinas. His march through South Carolina lasted six weeks. In North Carolina he encountered considerable opposition, and fought two pitched battles. Goldsboro' was occupied on the 22d of March, 1865, Raleigh on April 13th. On the 26th of April General Johnston surrendered his army to Sherman on the same terms as had been granted to General Lee by General Grant. This surrender virtually closed the war. General Sherman con-

tinued in command of the military division of the Mississippi a year after the end of the hostilities, with the rank of Major-General in the regular army. He was promoted to Lieutenant-General when in July, 1866, Grant had been made General of the Army. His command continued as before. Sherman succeeded Grant as General of the Army in March, 1869, after the election of the first named to the Presidency.

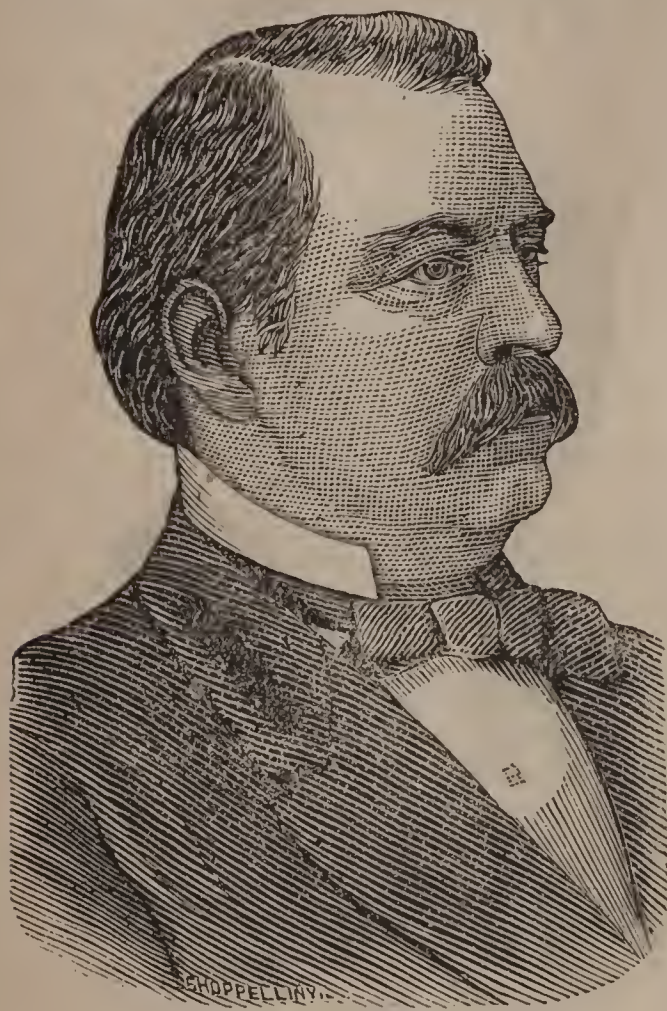
Philip H. Sheridan. - On February 9, 1865, the thanks of the United States Congress were tendered to a man for the gallantry, military skill and courage displayed in a series of victories, achieved by his army, in the Valley of the Shenandoah, especially at the battle of Cedar Run. This man was Philip Henry Sheridan, familiarly known as "Little Phil." He was born in Somerset, Perry County, Ohio, in 1831, was educated at West Point, and was admitted to the Military Academy in 1848, where he graduated in 1853. Entering the United States Artillery, he served in Texas and Oregon until 1855, when he sailed for San Francisco, in command of an escort to a United States surveying expedition. From this time until 1861, he commanded a body of troops among the Indian tribes, when he was promoted to the rank of Captain. Upon the breaking out of the civil war, he was appointed Quartermaster of the Western Department, and Colonel of the Second Michigan Volunteer Cavalry. At Booneville, in July, 1862, he was promoted to the rank of Brigadier-General of volunteers, and took command of the third division of the Army of the Ohio, distinguishing himself by his defence of Louisville, and again winning distinction on the banks of the Stone River, December 30th, at which time he was promoted to the rank of Major-General of volunteers. He was appointed in April, 1864, to the command of the cavalry corps of the Army of the Potomac. In September, 1864, he was appointed Brigadier-General, and in November of the same year Major-General of the United States Army. He was in command of various military divisions of the army from June 3, 1864, until September 12, 1867. On March 4, 1869, he was appointed Lieutenant-General of the United States Army, and the same month took the command of the military division of the Missouri. He was in command of the Western Division, with headquarters at Chicago, until 1879, and commanded the forces which were sent to quell the Louisiana



PHILIP H. SHERIDAN.

difficulties. The cavalry branch of the Federal forces under his able direction acquired an efficiency and gained a reputation such as it had never borne before. Sheridan recently succeeded Sherman as Commander-in-Chief of the United States Army.

Grover Cleveland.—Mr. Cleveland is a native of New Jersey, born at Caldwell, Essex County, March 18, 1837. His father was a minister. After receiving such instruction as was procurable from the common school in



GROVER CLEVELAND.

various places of the parental residence, young Cleveland was sent to the Academy, Clinton, Oneida County, New York. Upon leaving this seat of learning, he went to New York City, where he filled for some time the position of clerk in an institution of charity. He is next heard of making his way West, in company with an enterprising young man, with Cleveland, Ohio, as his objective point; but visiting, while on his way, an uncle residing in Buffalo, he was induced to remain in that city, as clerk in the store of his relative. He was eighteen years of age at the time, an ambitious young fellow possessed of the earnest desire to become a successful lawyer. His uncle favored this aspiration, and we soon find the youth a clerk in the office of a prominent law firm and at the same time enjoying the comforts of a good home at his relative's house.

He was admitted to the Bar

in 1859. His first political office was as Assistant District-Attorney for the County of Erie, under C. C. Torrance. He held the position three years, until the end of his superior's term of office, when he was nominated for District-Attorney on the Democratic ticket, but defeated. In 1870, five years after this failure, he was elected Sheriff of Erie County; and in November, 1881, was elected Mayor of Buffalo by a decisive majority. So admirably did he perform the functions of this office that his fame as a reformer soon spread throughout the State, and in 1882 he was nominated for Governor. The Republican party was hopelessly divided, and Mr. Cleveland was elected by the enormous majority of 192,000. This phenomenal success, coupled with his very satisfactory administration of the State government, gave Mr. Cleveland a national reputation, and in 1884 the Democratic party, in convention at Chicago, nominated him as its candidate for President. The Republican candidate was James G. Blaine, and an animated and

sharply contested campaign followed, but Mr. Cleveland was elected, and on March 4, 1885, was inaugurated President of the United States.

Thomas A. Hendricks.—Thomas Andrew Hendricks was born in Ohio on the 7th of September, 1819. He was graduated from South Hanover College in that State in 1840, when he removed to Chambersburg, Pennsylvania, and began the study of law. Three years later he was admitted to the Bar and began the practice of his profession in Indiana. His career opened auspiciously and in a few years he became a lawyer of excellent standing. In 1848 he was elected to the State Legislature, and in 1850 was a delegate to the State Constitutional Convention. The next year he was elected to the House of Representatives, and in 1853 his term expired. He was appointed Commissioner of the General Land Office by President Pierce, and from this on he has been one of the most important political characters in Indiana. In 1860 he ran for Governor against Henry S. Lane, and was defeated. He was elected to the United States Senate in 1863 for the long term. Here he won considerable distinction as a debater and served with marked ability in the Committees on Claims, Public Buildings and Grounds, the Judiciary, Public Lands and Naval Affairs. His name was presented to the Democratic National Convention in 1868 as candidate for the Presidency, and he would no doubt have received the nomination but for the Ohio delegates, who by persistently voting for Horatio Seymour finally caused a stampede in his favor. The friends of Mr. Hendricks have always insisted that his nomination would have insured a Democratic victory. Again in 1872 he was proposed as a candidate in the Democratic National Convention, and but for the unexpected fusions of that time he would probably have been the nominee of his party. He was nominated for Vice-President in 1876 upon the ticket with Samuel J. Tilden, and for the same office in 1884, Grover Cleveland being the candidate for the Presidency, and was elected.



THOMAS A. HENDRICKS.

HISTORY.

The Battle of Waterloo.—The decisive conflict which annihilated the power of Napoleon I, was fought June 18, 1815, in a plain about two miles from the village of Waterloo, and twelve miles south from Brussels. Agreeably to the unanimous resolve of the Allies to attack Napoleon on all sides, and crush him as they had done in 1814, British and Prussian troops were stationed in the Netherlands, under the command of Wellington and Blücher respectively, in order to attack France on the north. Napoleon, on his side, well aware that for a considerable time no weighty attack could be made on France except by these forces, and fully recognizing the immense advantage to be gained by destroying one enemy before the others could come up, rapidly concentrated the bulk of his troops; and with a suddenness and secrecy which defied all effective counter-preparations, crossed the Belgian frontier, and fell with one part of his forces on the Prussians at Ligny, and with the other part, under Ney's immediate command, on the army of the Prince of Orange at Quatre-Bras. The Prussians—as Wellington, after learning Blücher's dispositions for the battle, had foretold—were, after a contest of the most obstinate description, completely defeated; but the Prince of Orange, by the aid of the reinforcements promptly forwarded to him by the English commander, succeeded in withstanding Ney's attack. In the plan preconcerted by the Allied generals such a result was not unforeseen, and in accordance with their scheme of firm resistance and retreat if necessary (to allow time for the Russians and Austrians to assemble on the eastern frontier of France), Blücher retreated northwards (instead of eastwards, as Napoleon expected) nearer the place of rendezvous with Wellington at Mont St. Jean; while early on the morning of the 17th, the Anglo-Netherlanders retired along an almost parallel route till they reached the forest of Soignies, in front of which they were formed in battle array, facing southwards. Napoleon, imagining that the Prussians were in total rout, and their complete dissipation would easily be accomplished by Grouchy's division (33,000 men), which he had sent in pursuit, crossed to Quatre-Bras with the rest of his troops, and uniting with Ney, marched in pursuit of Wellington, arriving on the plain of Waterloo in the evening.

The two armies which then confronted each other, though nearly equal in strength, were composed of very different materials. The French army, numbering from 69,909 to 72,247 men (according to French authorities, English historians varying in their estimate from 74,000 to 90,000, though its exact strength cannot be ascertained, owing to the loss of the official returns), was composed of veteran troops, who had enthusiastically ranked themselves once more under the standard of the chief who had so often led them to victory. The Anglo-Netherlands army, which numbered 69,894, of whom only 25,389 were British, 6,793 of the king's German legion, 10,995 Hanoverians, 6,303 Brunswickers, 2,926 Nassauers, and 17,488 Netherlanders, consisted, with the exception of a small number of Peninsular veterans, wholly of young soldiers, a large proportion of whom had never been under

fire; the Hanoverians were only militia, some of them being fit but for garrison duty; while the behavior of many of the Belgian troops during the battle showed plainly enough that they mainly increased the *numerical* strength of the army, as they left it to the Dutch soldiers to vindicate the wrongs of the Netherlands. The French had 240, while their opponents had only about 156 guns. With such an army, to maintain even a defensive conflict with an army of veterans, commanded by the greatest general of the time, was a task which (laboring under a mistake as to the exact superiority in number of his opponents) it required all Wellington's rare tenacity of purpose to undertake; yet undertake it he did, depending on Blucher's promise to join him an hour after mid-day.

On the morning of the 18th, the two armies found themselves ranged in battle-array opposite each other; the Allies, posted on a line of eminences, had their left wing resting on Frischermont, the farm-house of La Haye Sainte in front of their center, while their right wing curved convexly round behind Hougomont, and rested on Braine Merbes. The French were ranged on a parallel row of eminences, having La Belle Alliance in their center, with some divisions of cavalry and infantry in reserve behind the right wing; Kellermann's dragoons behind the left wing; and the Guard, stationed with the 6th corps, in the rear. Skirmishing had continued all the morning; but the first serious attack was not made till between eleven and twelve, when a part of the first corps advanced against Hougomont, with the view of masking the more important attack to be made against the allied left. This preliminary assault, however, though unsuccessful, was maintained with great vigor for a considerable time; till Napoleon, dreading a further loss of time, prepared to make his grand attack on the left center. At this time (half-past one P. M.) he learned that the advanced guard of the 4th Prussian corps (Bulow's) was appearing in front of St. Lambert, two or three miles to his right; and being forced to detach his 6th corps (Lobau's) with the reserves of cavalry behind his right wing, to keep them in check, he had to modify his grand plan of attack on the Anglo-Netherlanders, and accordingly ordered Ney to break through their center. At two P. M., after a furious preliminary cannonade, from which Wellington sheltered his men (as at various other times during the battle), by retiring them to the reverse of the slope, Ney advanced against the left center with 20,000 men, but had only succeeded in putting to flight a Belgian brigade, when he was attacked and driven back by Picton's division, his retreating columns charged and broken by the English cavalry, and 2,000 prisoners taken. Nevertheless, after a brief space, Ney returned to the charge, and carried La Haye Sainte, though his repeated attacks on the infantry in position were constantly repulsed, and his retreating columns severely handled by the British cavalry, who, disordered by success, were as often overthrown by the French cuirassiers. By this time (half-past four P. M.), Bulow had succeeded in deploying from the woods, and, advancing against Planchenoit, in the rear of the French right, carried it after a vigorous conflict. Lobau's corps, however, aided by a reinforcement from the Guard, speedily retook the post, and driving the Prussians back into the wood, secured the French right flank for a time; Napoleon, though now learning that another Prussian corps (the 1st, under Ziethen) was coming up by Ohain to join the Allied left, being still confident that he could destroy the Anglo-Netherlanders before the Prussians could render effective aid. During the conflict with Bulow, Ney had been warmly engaged with the center and right of the enemy, who had made various attempts to regain the wood of Hougomont and La Haye Sainte, and

had supported his repeated attacks with not only his own cavalry, but (by at any rate, the "tacit consent" of the Emperor) with the cuirassiers, lancers, and chasseurs, of the Guard, and the whole of the mounted reserve, without, however, producing any result other than a great slaughter on both sides, and the useless sacrifice of 18,000 of the finest cavalry ever seen. Napoleon now resolved on another vehement assault on the immovable British center, and directed against it in succession two columns, one composed of four battalions of the Middle Guard, and the other of four battalions of the Middle and two of the Old Guard, supporting them with flank attacks of other infantry divisions, of cavalry and with a dreadful fire of artillery. The advancing French were met with a well-sustained fire from every piece which could be brought to bear upon them; the first attacking column was fairly driven down the slope by the English Guards, and the second was totally routed by a bayonet-charge of Adam's brigade, the British cavalry following up the fugitives. Ziethen had now (seven P. M.) joined the left of the English line; Bulow, further reinforced, had carried Planchenoit, and was driving the French right wing before him; and the combined attack on the retiring masses of the French by the whole effective force of the Anglo-Netherlanders on the one side, and of the Prussian cavalry on the other, converted an ordinary, though severe defeat into a rout unparalleled in history. The magnificent cavalry, wantonly destroyed by Ney in fruitless attacks upon an "impracticable" infantry, would then have been of incalculable service, but they were no longer to be had. The last square of the Guard still stood its ground, to protect the flight of the Emperor; but it was speedily surrounded, and on the soldier-like refusal of Cambronne to surrender, was in a moment pierced through, and broken to pieces. From this time all resistance was over; the roads southwards, especially that to Genappes, were crowded with fugitives fleeing for their lives from the pursuing cavalry; and though the English light cavalry, exhausted with their severe work during the battle, soon ceased the pursuit, it was kept up with great energy throughout the whole night by the Prussian troopers, who seemed bent upon at once avenging the defeats of Jena, Auerstadt, and Ligny, and glutted their fierce animosity by an indiscriminate slaughter. The total loss in this battle was, from the obstinacy and determination with which it was contested, necessarily large; the figures are: British and Hanoverians, 11,678, Brunswickers, 687; Nassauers, 643; Netherlanders, 3,178; a total of 16,186, which, added to 6,999 Prussians, gives the aggregate allied loss, 23,185. The French had 18,500 killed and wounded; 7,800 prisoners (some French accounts raise the total list of *hors de combat* to 32,000), and 227 cannon captured.

The Massacre of St. Bartholomew.—In order to properly understand the events that led to the great political and ecclesiastical crime of 1572 a short review of the three preceding reigns is necessary. Frenchmen still look back with pride to the memory of Francis I. A king of great virtues and equally great vices, of noble aspirations but of ignoble passions, never bigoted except when frightened by priests, the friend of painter and scholar, but dying at last from a disgusting malady brought on by his licentious amours.

In 1544 Francis chanced to be ill of a dangerous malady. The bigoted Cardinal de Tournon persuaded him that his illness was a judgment of God to punish him for not extirpating heresy in France, and the king ordered the Waldenses of Provence to be exterminated as a cure for his malady. This

peaceable, industrious and God-fearing race had been a living protest against the church of Rome for hundreds of years, but now an expedition was sent among them commanded by John Menier, Baron of Opede, who declared, "I know how to treat these people; I will send them one and all to hell." So far as lay in his power he fulfilled his word by murdering 3,000 people and burning twenty-four villages. The tale of the atrocities committed in Provence awoke a cry of indignation from one end of the country to the other, and the cloud of religious war that was already hovering over France grew black and ominous.

Francis was succeeded by his second son Henry, who ascended the throne in 1547. Henry's queen was the celebrated Catherine de' Medici, of whom we shall hear more hereafter. He was a prince of dull and commonplace intellect, chiefly distinguished for his skill in the tournaments.

During this reign the reformed religion spread rapidly, although the edicts against dissenters were enforced with great severity. In Poitou and Anjou the fires of persecution blazed so fiercely that the Reformers meditated taking up arms, but were dissuaded from so doing by their leader Calvin.

France was at war with Spain during a great part of this reign. After the fall of St. Quentin, at which Admiral Coligny—so famous both for the greatness of his character and from the fact that he was the first victim of the Massacre of St. Bartholomew—was taken prisoner, peace was concluded on the 3rd of April, 1559. William of Orange was sent as a hostage to Paris by the King of Spain, and one day while hunting in a forest, the King confided to him a plan he had formed for the extermination of the Huguenots at a single blow. From the taciturnity and presence of mind with which he received so startling a revelation, the liberator of the Netherlands received the title of William the Silent. This is ample proof that the great massacre was contemplated as early as 1559, although two kings died and thirteen years rolled away before its execution.

In June an edict was issued more severe than any that had gone before. By it, all convicted Lutherans were to be punished with instant death without chance of remission. There is but little doubt that if this decree had been enforced as Henry intended it should be, Protestantism would have been crushed out of France as it was of Spain. But this was not to be. During the same month, at a grand tournament, the king was wounded in the eye by a splinter from a lance. The wound was mortal, and on the 10th of July, 1559, the sceptre of France fell from the dead hand of Henry the Second.

Francis the Second, a youth of weak body and dull intellect, the eldest son of Henry, and husband of the unfortunate and beautiful Mary of Scotland, ascended his father's throne on the 10th of July, 1559, at the age of sixteen. His mother, Catherine de' Medici, who had remained in the background during the reign of Henry, now became one of the chief political forces of the kingdom. It now became evident that she was a consummate mistress of the art of political intrigue, by her success in playing the rival houses of Guise and Bourbon one against the other. The Guises being at this time most in favor of the King, a conspiracy was formed to accomplish their overthrow. It failed, however, and was followed by another wholesale butchery, chiefly instigated by the Duke of Guise and his brother, the Cardinal of Lorraine. The cruelties practiced at this "massacre of Amboise," as it is called, had so exasperated the people, and the symptoms of a general outbreak of the Huguenots, who had now become very powerful,

were so alarming, that the Government was forced to make concessions. An edict was published making the bishops and clergy the sole judges for offences against religion, which had the practical effect of preventing the establishment of the inquisition in France, and the States-General were convoked for the first time in seventy-six years. The cause of the reformers was eloquently advocated by the Admiral Coligny, who presented a petition from the Huguenots, asserting their love for the King, but praying that a stop be put to the cruel persecutions under which they were suffering, and for permission to read the Bible, and hold their meetings in the open day. "But your petition," said Francis, "has no signatures." "That is true, sire," replied Coligny, "but if you will allow us to meet for the purpose, I will in one day obtain in Normandy alone 50,000 signatures." "And I," interrupted the Duke of Guise, "will find 100,000 good Catholics to break their heads."

Louis, Prince of Conde, and Henry, King of Navarre, who had been secretly allied with the reformers, were at this time under sentence of death, and were only saved by the timely death of the King, which took place on the 5th of December, 1560, after a reign of eighteen months, the shortest in French annals.

Francis, dying childless, was succeeded by his brother Charles, a child of ten years. Catherine now assumed as her right, the exercise of sovereign power in the name of her son. Her first act was to divide the great offices between the families of Guise and Bourbon, her object being to hold the balance evenly between them. This and other well-intentioned acts on the part of the Government were rendered fruitless by the intensity of the hatred between the rival religions. Disturbances were general throughout the kingdom, and the furious fanaticism of both sides found many victims. The civil war which had long been imminent, was precipitated by what is called the "Massacre of Vassy." The Duke of Guise, traveling with a retinue of 200 armed gentlemen, stopped at the little town of Vassy, in Champagne, where, the day being Sunday, Protestants were assembled for divine worship. By the Duke's order, his attendants tried to disperse the gathering. They resisted, and an unequal conflict ensued. The Duke was struck on the cheek by a stone, whereupon his enraged soldiers fired upon the unarmed multitude, killing sixty and wounding over 200. The Huguenots now rushed to arms, and France became the theatre of civil war. Under their leaders, Coligny and the Prince of Conde, they fought with varying success until a peace was concluded in 1563, by which they obtained permission to worship in the houses of the nobility and gentry, and in one town in every Bailliage. This was, however, of short duration. Some conferences between Catherine and her daughter Elizabeth, wife of the King of Spain, together with the reports of the atrocities committed by the Duke of Alva in the Netherlands, excited the suspicions of the Huguenots, and in 1567, war was recommenced by an attempt on their part to seize the King and his family, with a view to a complete change of Government. With the exception of a short truce in 1568-'9, the combat raged until 1570. At first the Huguenots met with many disasters, but the tide of battle turned and their successes in the campaign of 1570, secured for them the treaty of St. Germain, by which they obtained the free exercise of their religion throughout the kingdom, with the single exception of the capital; they were admitted on equal terms with the Catholics to all professions and public employments, and restitution was granted for all forfeited offices and confiscated property.

The Huguenots were now lulled into temporary security by the efforts of

the courts to mitigate the bitter hostility of parties. Admiral Coligny had at last overcome his deep-seated distrust, and repaired to Blois, where he was received by the young King with open arms.

However, the favor and ascendancy of the Protestants served only to intensify the hatred of the Catholic party, and it was apparent to many that a crisis was approaching. The sudden death of the queen of Navarre, under strong suspicion of poison, so alarmed the reformers that many fled from Paris. Coligny still remained, in spite of the remonstrances of his friends. Early in the summer of 1572, an expedition to the Netherlands was fitted out under his direction, by which many important places were taken, but a reverse occurring, the council were divided on the course to be pursued. The Admiral and his adherents demanded an immediate declaration of war with Spain. Catherine and the Guises ranged themselves on the opposing side, and thus becoming in direct collision with Coligny, determined on his death. It was arranged that he should be assassinated by some retainer of the Guises. This would produce an insurrection of the Huguenots to avenge his death, whereupon the populace of Paris were to be instigated to rise and exterminate the weaker party in a wholesale massacre.

On the 18th of August, the marriage of Henry of Navarre and Margarete of Valois took place, and aroused popular commotion to the highest pitch. Strange and fearful rumors of impending calamity gained ground in the capital. Three days after, as the Admiral was returning from the Louvre, he was fired at from a window by an agent of the Duke of Guise, and wounded in the head and arm. When the news was brought to Charles, he exclaimed passionately, "Am I never to be left in peace?" but went at once to see his wounded friend to assure him of his affection, and that he would at once exact a signal vengeance for the outrage. Coligny complained bitterly of the malign influence of Catherine, and urged the King to deprive her of power, offering the aid of the whole Protestant party to effect this purpose. The conspirators were now struck with consternation. Their first blow had failed, for the Admiral's wounds were not dangerous, and they were menaced with exposure and ruin. After an agitated consultation, they went in a body to the King, and conjuring up before him dreadful visions of renewed civil war, revolution, foreign aggression and personal violence, urged him to consent to the death of the Admiral and other leaders of the Huguenots. The monarch yielded, after a long and painful struggle. Starting up suddenly in one of those transports of delirious fury to which he was subject, he ordered, with fearful execrations, that since it was necessary to shed the blood of the Admiral, not a Huguenot should be left alive in his kingdom to reproach him with the deed.

On the Feast of St. Bartholomew, August 24th, 1572, the great bell of St. Germain l'Auxerrois rang out at the unwonted hour of two in the morning. This was the appointed signal. It was instantly repeated from all the steeples of the capital. Lights were suddenly shown in every window. The assassins, armed to the teeth, and distinguished by white crosses in their hats, swarmed forth from their lurking places in every quarter of Paris, and the work of death began. The first victim was the illustrious Coligny. The wounded Admiral was awakened by tumultuous knocking, and voices crying, "Open in the King's name!" The Dukes of Guise and Aumale, with a band of myrmidons were at the gate. The frightened servants ran to see what caused the tumult. Some were killed and some escaped upstairs and barricaded the doors with furniture. Coligny, who was alone with Ambroise Pare the surgeon, knew well the meaning of the uproar, and

yet remained as calm as though no danger was impending. In a few moments the feeble barrier was dashed aside, and a band of ruffians entered, one of whom, advancing his sword to the breast of the wounded man, exclaimed, "Are you not the Admiral?" The answer was, "I am; but, young man, you should respect my grey hairs and not attack a wounded man. But what matters it? You cannot shorten my life except by God's permission." The German soldier with an execration, plunged his sword into the old hero's breast, and his body was thrown from a window to Henry of Guise, who was waiting below, and who refused to take any evidence but that of his senses, that his great enemy was dead.

When the harsh sound rang from the belfry of St. Germain l'Auxerrois, it was caught up and echoed from tower to tower, rousing all Paris from their slumbers. Immediately from every quarter of that ancient city, uprose a tumult as of hell. The clanging bell, the crashing doors, the musket shots, the rush of armed men, the shrieks of their victims, and high over all the yells of the mob, fiercer and more pitiless than hungry wolves, made such an uproar that the stoutest hearts shrank appalled, and the most sane appeared to have lost their reason. Women unsexed, men wanting everything but the strength of wild beasts, children without a single charm of youth or innocence, crowded the streets where the rising day still struggled with the glare of a thousand torches. They smelled the odor of blood, and thirsting to indulge their passions for once with impunity, committed horrors that have become a marvel of history.

Within the walls of the Louvre, and in the hearing of Charles and his mother, if not actually in their sight, was enacted one of the most foul scenes of this detestable tragedy. A list of the names of the Huguenot gentlemen in attendance on the King of Navarre was read, and as each man answered to his name, he was forced to step into a courtyard, where sword and spear made short work of him. Thus perished 200 of the best blood of France.

The houses in which the Huguenots lodged were easily known, having been registered. The soldiers burst into them, killing all they found, without regard to age or sex, and if any escaped to the roof, they were shot down like pigeons. Daylight served to facilitate a work too foul even for the blackest midnight. Restraint of every kind was thrown aside, and while men were victims of bigoted fury, the women were exposed to violence unutterable. Marshal Tavannes, the military director of this deed of treachery, rode the streets with dripping sword, shouting, "Kill, kill! the doctors say that blood-letting is as good in August as in May." In making his dying confession, this Tavannes was reminded that he had made no allusion to St. Bartholomew's day. "That," he replied, "I look upon as a meritorious action, which ought to atone for all the sins of my life." Such was the spirit that animated the sectaries of the 16th century.

The massacre soon exceeded the bounds anticipated by the conspirators. Toward evening the King gave orders to put a stop to the bloody work, but it was found that the demons he had unchained were not so easily appeased, and the carnage continued unabated during several days. Similar enormities were committed in all the more important provincial towns, the history of which would far exceed the limit assigned to this article. The whole number who perished is given by the most trustworthy authorities as about 20,000.

There were great rejoicings in Rome, and at the court of Spain, when the news was received, but it sent a thrill of horror through Protestant England,

and it was some days before the French Ambassador was received at court there. On his deathbed, Charles is said to have suffered great agonies of remorse over the cruelties that had disgraced his reign.

It is only necessary to add that here, as elsewhere, history teaches the lesson that such violent measures almost always operate for the cause that they are directed against. In less than a year the Huguenots had recovered from their temporary demoralization, and were in position to address the King in bolder and more importunate language than ever before, and soon a third and more powerful party was formed by a coalition of the Huguenots and moderate catholics.

As a purely gratuitous massacre, the Feast of St. Bartholomew remains without a parallel in the annals of the world. The Greeks of Lesser Asia rose and slew 80,000 Romans living among them, the Britons massacred whole settlements of the invading Danes, and at the Sicilian vespers 20,000 French were put to death without distinction of age or sex. But these massacres were all committed in the name of freedom—to drive out a foreign conqueror, to throw off the yoke of an invader. The motives that animated the conspirators in Paris were of the lowest kind—envy, jealousy, greed, ambition.

The Inquisition or Holy Office.—Carlyle has somewhere noted in dispraise of written history, that those facts are more often preserved which tend to retard the progress of civilization, than those other which aid in its advancement. As such, he speaks of the records of wars, conquests, cruelties and persecutions. But while we own with candor the over fondness of the human mind for the dramatic and thrilling incidents contained in such records, we cannot for a moment deny their instructiveness and value.

The history of the institution of which we purpose to write, is one replete with horrors. From a thousand blazing piles of fagots, we may yet hear the pain-wrung cries of women, men and children that were uttered three centuries or more ago. For most of them a word would have purchased absolution, but that word was false, and remained unspoken. On the one hand, the astonishing fortitude of human beings perishing, for a principle, by the most painful processes that human ingenuity, aided by the most inveterate hate and fanaticism could devise. On the other, the persecutor, trained by tradition and by education, to believe his trade in truth a "holy office," and one deserving the richest rewards of earth, the most felicitous enjoyments of heaven. For few, we must believe, acted from the pure love of cruelty. The powers that were, doubtless, knew how to select their instruments, and chose men of a hard and ambitious cast of character. But that these were actuated largely by a sense of duty, and of the importance of preserving intact the tenets of the mother church, we cannot doubt. Did these events retard the progress of civilization? Was not the progress of civilization and of the Reformation the same? Does not history teach that principle and sect thrive best when persecuted? The light of reason was shining there, though forced to hide and tremble, and what was still more potent for good to the cause of Luther, and of Calvin, the great heart of the people of Europe was rightly placed, and pity dwelt there as it does in the hearts of men to-day. We may not lightly conclude but that the baleful fires of Torquemada did as much to aid the onward movement of the Reformation, as did the iniquitous sale of indulgences, to secure its birth.

From its early ages, the Christian church had claimed the right to not only look after the spiritual welfare, but to inquire into the doctrinal sound-

ness of all people where it was established, and laws more or less rigorous existed for the punishment of all dissenters from the national creed. During the reigns of Theodosius and Justinian, officials called Inquisitors were appointed, whose duty it was to cite persons suspected of heresy before the civil tribunals.

Their sentences usually took some mild form of ecclesiastical censure, although occasional cruelties were practised. During the eleventh and twelfth centuries, however, the spread of certain sects known as the Cathari, Waldenses, and Albigenses, alarmed the church authorities, and measures were taken to perfect the inquisitorial system for the suppression of heresy. In 1248, under Pope Innocent IV, the form of the institution was changed from that of a local tribunal, for the suppression of certain sects as they arose, to that of a permanent establishment, to be introduced into the different countries where the Papal power was recognized. Thus constituted, and under the Dominican order of monks, it was introduced into Italy, Spain, Germany and the southern provinces of France.

The operation of the inquisition was as follows: In each parish a number of persons were sworn to give information of all who were suspected of holding heretical opinions, who attended secret meetings, or departed in any way from the established customs of the church. In some cases, nearly all the inhabitants of a parish were thus made sworn informers. Any person refusing to qualify as an informer, by taking the oath, was himself suspected of heresy. To conceal the crime of others was punished by confiscation of property, and deprivation of office.

Persons suspected were reported to the bishops. They were then thrown into prison, to be released for trial at the pleasure of the judges. In case of inactivity on the part of the bishops, they might be deprived of office by the Legates of the Pope, by whom the process of extirpation was controlled. The accused, when brought to trial, was not confronted with his accusers, nor were their names made known to him. The evidence of an accomplice was admissible, and the accused himself was often put to the torture to extort a confession from him. If found guilty, he was liable to death by fire or the scaffold, imprisonment in the galleys for life, or for a limited period, forfeiture of property, civil infamy, or in minor cases, retraction and public penance. He who concealed the guilty, was regarded as an offender of the gravest kind, and was punished by the confiscation of his property, and deprivation of office. In sickness, no medical attendance was permitted them, and they were forced to depart from their homes clad in a garb betokening their infamy.

All these conditions the Papal authority had power to enforce. The agents of the Pope were well chosen. The emoluments of their office were enormous, and from their greed and zealous eagerness in performing the duties assigned to them, they earned the punning title, on the name of their order, of "Domini Canes," or dogs of the Lord. The character of some of the Papal legates may fairly be estimated by an incident in southern France.

During the first part of the thirteenth century, the Papal Legate and inquisitor, Peter of Castelnau, who had been commissioned to extirpate heresy in the dominions of Count Raymond VI of Toulouse, was murdered. A crusade was undertaken, under the direction of Legates Arnold and Milo, and under the military conduct of Simon of Monfort. The ostensible object of the expedition was to revenge the death of Peter, but its real purpose was to punish Count Raymond, who had become an object of hatred to the Papal

authorities, by his toleration of the Albigenses in his domain. It was in vain that the Count submitted to the most humiliating penance and flagellation at the hands of Milo. The town of Beziers was taken by storm, and twenty (some authorities say forty) thousand people, both Catholic and heretics, were massacred. "Kill them all," said Legato Arnold, "God will know his own."

At the beginning of the 15th century, the arrogance and avarice of the Romish church had reached a point at which the movement, which was to undermine its temporal power, was inevitable. Wycliffe in England, Jerome of Prague, and Huss, the Bohemian martyr, were beginning to strike the chords of awakening reason. But the overbearing spirit of the church was too strong for the reforming spirit in its early manifestations. In the midst of his evangelical activity, Huss was betrayed, through promise of a safe-conduct, into making his appearance at the council of Constance in 1414. No sooner was he fairly in the power of the council, than he was confronted with certain articles of abjuration, and refusing to submit without being convinced, he was, in defiance of the promise made to him, condemned to be burned as a heretic. The rising spirit of the Reformation was for a moment quenched in the flames that consumed the intrepid martyr of Bohemia.

A little further on, the sale of indulgences, by which the church granted absolution and release from the pains of purgatory for all crimes committed, or to be committed, by any persons who would pay to the church a fixed sum of money, awoke from a life of asceticism, that leading spirit of the Reformation, Martin Luther. From his fiery utterances, the movement spread rapidly through Germany, and obtained a foothold in different parts of Europe. For the first time the Papal throne was made to tremble. Here was a spirit not to be intimidated. A Papal bull, that fearful instrument that had made so many kings bow their heads in submission, was by him publicly burned at the gate of Wittenberg. Translations of the Scriptures were being made, and although fiercely condemned by the church, found many secret hiding-places.

Against this rising spirit were set to work all the intricate and deadly machinery of the inquisition. Volumes would be required to give an account of the struggle in all the different countries of Europe. We will confine ourselves to some transactions in Spain, and in the Netherlands.

In Spain, the office of Inquisitor-General was first filled by Thomas de Torquemada, a friar of the Dominican order, whose cruelties have made the name of the Spanish Inquisition infamous in history. During the sixteen years of his tenure of office, 9,000 persons perished in the flames.

The ceremony preceding these executions was called an *Auto da Fe*, or Act of Faith, and was often attended by the King and first grandees of Spain. It was held on a Sunday or Holy-day. At dawn the dismal tolling of the great bell of the high church, gave the signal to begin the drama of the day. The procession was led by the Dominicans, carrying the flag of the Inquisition. Next followed the penitents on whom only penance had been laid. Behind them, and separated by a great cross which was borne before, came those condemned to death—bare-foot, clad in the *san-benito* and with a pointed cap upon their heads; then effigies of the fugitives; and lastly the bones of dead culprits, in black coffins, painted with flames and hellish symbols. The frightful train was closed by an army of priests and monks. The procession went through the principal streets to the church, where, after a sermon on the true faith, sentence was pronounced. A few hours after-

wards, they were brought to the place of execution. If they yet, at the last, made profession of the Catholic faith, they were so far favored as to be first strangled; otherwise they were burned alive.

In 1540, Francisco San-Roman, a native of Burgos, was sent by his employers to Bremen, to transact some business. While there, he became a convert to the reformed doctrines. Some Lutheran books being found in his possession, he was seized and thrown into prison, where he remained for eight months. Afterwards, for a too free avowal of his sentiments on the occasion of an introduction to the Emperor Charles, he was again delivered over to the Inquisition at Valladolid. When brought before the inquisitors, he frankly avowed his belief in the cardinal doctrine of the reformers, and pronounced the mass, auricular confession, purgatory, the invocation of saints, and worshiping of images, to be a blasphemy against the living God. He refused at the place of execution to purchase a mitigation of punishment, by confessing to a priest, or bowing to a crucifix which was placed before him. When the flames first reached him, he made an involuntary motion of his head, and the friars exclaimed that he had become penitent, and ordered him to be brought from the fire. On recovering his breath, he looked them calmly in the face and asked, "Did you envy my happiness?" at which he was thrust back into the flames and almost instantly suffocated.

The second Auto da Fe in Valladolid, took place on the 8th of October, 1559. Twenty-nine prisoners appeared on the scaffold, of whom sixteen wore the garb of penitents, while the flames painted on the san-benitos of the remainder, marked them out for the stake. At the head of those devoted to death was Don Carlos de Seso. Arrested at Logrono, he was thrown into the secret prison of the Inquisition, and on the 28th of June, 1558, answered the interrogatories of the fiscal. His conduct during the whole of his imprisonment and in the terrible scene with which it terminated, was worthy of his noble character and the active part which he had taken in the cause of religious reform. When informed of his sentence, he called for pen, ink and paper, and having written a confession of his faith, gave it to an officer saying, "This is the true faith of the Gospel, as opposed to that of the church of Rome, which has been corrupted for ages." The whole of that night and morning was spent by the friars in an ineffectual attempt to induce him to recant. He appeared in the procession with a gag in his mouth. It was removed after he was bound to the stake, and the friars began again to exhort him to confess. He replied in a loud voice, and with great firmness, "I could demonstrate to you that you ruin yourselves by not imitating my example, but there is no time. Executioners, light the pile that is to consume me." They obeyed, and De Seso expired among the flames without a struggle or a groan.

At an Auto in Seville, on the 22nd of December, 1560, no fewer than eight females of the most irreproachable character, suffered the most cruel of deaths. Among these were Maria Gomez, her sister and three daughters. After the reading of the sentence which condemned them to the flames, one of the young women went up to her aunt, from whom she had imbibed the Protestant doctrine, and thanked her for the religious instruction she had given her, and implored her dying blessing. The five friends took leave of one another with tender embraces, and words of mutual comfort. The interview between these devoted women was beheld by the Holy Tribunal, with a rigid composure of countenance, undisturbed even by a glance of displeasure, and so completely had superstition and habit subdued the strong-

est emotions of the human breast, that not a single expression of sympathy escaped from the multitude at witnessing a scene which, in other circumstances, would have harrowed up the feelings of the spectators and driven them to a mutiny.

The foregoing are but samples of what was taking place all over Europe, during the great struggle for freedom of conscience. In the Netherlands, the Inquisition was introduced in the 13th century, and severely enforced under the Spanish Emperors, Charles V and his son Philip II. The latter was probably the most inflexible and bigoted tyrant of modern history. He it was who replied to one of his subjects on the way to the stake, who asked: "Canst thou, sire, thus witness the tortures of thy innocent subjects?" "I would carry the wood to burn my own son, were he as wicked as thou." That he would have done so is amply proven by the fact, that the evidence scarcely admits of a doubt that his son Carlos did eventually die by poison, administered by the direction of his father.

The struggle of the Netherlanders for civil and religious liberty was long and obstinate, and involved them in a war of eighty years' duration. Fortunate for them, their oppression awoke the strong arm and patriotic heart of William the Silent, Prince of Orange, without whose wise guidance the final victory could never have been won.

In 1567, the Duke of Alva was sent to the Netherlanders by Philip, to act as Governor-General. On arriving there he established what was called the Council of Troubles, and renamed by the people the Council of Blood. The proceedings of this body were summary in the extreme, and its justice may be fairly estimated by an anecdote of one of its members, Counciller Hessesels. This worthy was accustomed to sleep through the dry and uninteresting evidence in defence of the accused, and awaking with a start at the conclusion of the testimony, shout out, "To the gallows with him! To the gallows with him!" It would be a useless labor to relate particular instances of the atrocities committed by a tribunal composed of men like this. "Columns and stakes in every street, the door-posts of private houses, the fences in the fields were laden with human carcasses strangled, burned, beheaded. The orchards in the country bore on many a tree the hideous fruit of human bodies." This is the moderate testimony of the historian Motley. Suffice it, that at last "Liberty did triumph," and the power of the Spanish throne was driven from the Netherlands forever.

But a little more than a century has elapsed since the fires of the Inquisition were kindled for the last time. The progress of civilization makes it seem impossible that such scenes should ever be enacted again. Of the thousands who perished, the names of but few have come down to us. Their martyrdom was suffered, that men might come at last to know the truth of that which was said so many centuries before by Gamaliel, "That if these doctrines be new, and of the world, and men pleased by their novelty, they will soon die of themselves, but, if they be from God, no mortal will be able to stop their progress."

The Reign of Terror in Paris.—The following description of this exciting period in French history is from the stenographic report of a lecture delivered by Mr. John L. Stoddard in the Academy of Music, Brooklyn, New York:

"A most deplorable state of affairs was that brought on by the revolution in the latter part of the eighteenth century. Louis XVI and Marie Antoinette had attempted to escape, but were captured and brought back to

the royal palace in the Tuileries. Hardly had Louis entered Paris when he apologized for his escape and swore to his people that in future he would be faithful to the nation and carry into effect all the decrees of the government. Great was the festival upon the return of the king. At the Champs de Mars, France and Paris rejoiced at Louis' return, and made memorable the occasion by numerous signs of great joy. Balloons were sent up, from which were scattered far and wide copies of the constitution which the ruler had promised to obey. Yet when Louis returned to his chamber he is said to have wept. He could not accept or reject the constitution, and could only cry out, 'What can I do?' It was almost the united wish of the French people that there should be a limited monarchy. But there came the advocates of a republic who would not believe that the King meant to keep his second oath. The crisis was fast approaching. It came at length. Louis was taking no measures to defend the realm. In the Tuileries the royalists were planning to assert their power, and what wonder was it that the friends of Liberty, seeing that the enemy most to be feared was in their own court, stirred up the people to strike at the Tuileries and put the conspirators to the sword? They had destroyed the Bastille, taken Versailles, and now came the destruction of the Tuileries—the King's palace. The King had the right of veto. He refused to sanction certain decrees of the Assembly. The people became aroused and assembled together with their banners and mottoes calling for the death of the King, who was no longer the protector of their rights. They stormed the palace, and he ordered the gates of the Tuileries to be thrown open. Excited and fierce was the mob. They entered the room where the King stood. There was Louis surrounded by the petitioners. Physically he was no coward, however; otherwise he was weak and incompetent. 'Sire, fear nothing,' said a man in the crowd. 'Put your hand on my heart and see if I am afraid,' was Louis' reply. 'France has no better friend,' he added. 'Then put on the bonnet rouge,' cried the mob, and Louis, with the red cap on his head, was led to the window to be seen by the crowd without. 'If you love the people, drink to their health,' said a man, as he handed the King a glass of wine. Louis did as he was requested. The palace was cleared by the guards, and as the King saw reflected in one of the broken mirrors the red cap, he exclaimed to Marie Antoinette: 'It was not to see you thus insulted that I brought you here from Vienna.' The allied sovereigns issued a proclamation that the inhabitants of the towns and cities of France would be visited with war, and all Paris given over to destruction, if the Tuileries were destroyed. But this threat had little effect. From the tower of St. Germain Church rang forth the call to arms. All night long sounded the alarm bells from the same tower that gave the signal for the St. Bartholomew massacre many years before. But now a different cry was heard—it was the cry of the people fighting for their liberty. It was the 10th of August. The Swiss Guard remained faithful to the King, when early in the morning the populace rushed into the garden of the Tuileries, shouting: 'Down with the tyrant!' Marie Antoinette heard the shouts, and is reported to have said: 'O my God, they are insulting the King.' She drew a pistol from the belt of a grenadier, and going to Louis and handing him the weapon, said: 'Now is the time to show yourself a King.' An officer advised Louis to go at once to the Assembly, which he did. As he passed along, a faithful soldier said to him: 'Be sure of this, sire, the man who kills you dies the moment after.' Louis might have said in reply that it would be better to have the would-be murderer die the moment before, but it was no time for jest. The royal family entered the

Assembly chamber and found seats in the reporters' gallery. The Assembly was in session, and a vote was passed to suspend the King from office. The King was calm, dignified, unmoved. He said a few words to a messenger, who left the room. He was intercepted, and said that his orders were to bring the King his dinner. It was brought, and Louis ate heartily with death staring him in the face. In the meantime, the crowd had burst into the Tuileries, massacred the Swiss Guard and made prisoners of the Royalists. The royal family was imprisoned. Then came the King's trial and the verdict of death. Six hundred soldiers followed the carriage. It must have been an impressive scene. Despite the treachery and the villainy, there was something sad in the sight of a dethroned monarch being led to his death. It was a solemn trial. 'You are about to give a lesson to all the nations,' said the judge, when he had informed Louis that he was accused of treason. The judges each voted what should be the punishment. When the president arose to announce the vote, there had been 387 for death, a majority of 53 out of the 721 votes cast. The King was taken to the Place de la Concorde, a lofty platform was erected, where now stands the obelisk. 'I die innocent. I forgive the authors of my death; I pray that my blood may not fall on France, but that it may appease the wrath of my enemies,' were his last words, and the soul of Louis was ushered into eternity. Then came the Reign of Terror. The revolutionists were in a desperate situation. All France rose en masse. Young men rushed to the army, women made clothing, the children made lint for the wounded, while the old men inspired a feeling of terrible hatred, and the revolution continued until the allied forces were drawn from the country. There were two parties in Paris struggling for supremacy. The Jacobins were in power, and were the idols of the people. Danton, a natural leader of the people, believed that the only way to save France, was to destroy all who were deemed the least dangerous. A tribunal was formed to decide who should be guillotined. First suffered the Royalists, then came the Girondists. Marat was a member of the triumvirate. He was repulsive in appearance. He had the instincts of a tiger, and was continually calling for new heads for the guillotine. Charlotte Corday! the beautiful heroine of the Revolution, remarkable for her beauty and spotless character, resolved to strike down the Jacobin leaders. She called upon Marat; found him in the bath; gave him a list of names for death, and as he read them, with one blow of the dagger killed him. The act of Charlotte Corday was a mistake. She only gave greater impetus to the terror which reigned, instead of bringing about peace, which she had intended. 'She has killed us, but she taught us how to die,' said the enemy. Great was the courage of the twenty-two Girondists as they met their doom, and on their way to the Place de Greve, in the true spirit of French republicanism, they sang the 'Marseillaise' and continued to sing, the song growing fainter as the numbers decreased. In thirty-one minutes the twenty-two Girondist leaders were beheaded. Their memory was cherished by all true friends of liberty. Madame Roland, the noble patriot, soon after yielded up her life, and she it was who gave utterance to the famous sentence, 'Oh, Liberty, what crimes are committed in thy name!' The Reign of Terror was a constant succession of cruel tragedies. Marie Antoinette was confined to a cell where she suffered every indignity, and was then taken in a common cart to the guillotine where, looking upon the Tuileries, the former home of the proud queen, she died at the hands of the executioner, and her body was thrown into a coffin that cost 7 francs (\$1.40.) To die thus was terrible, but to die and leave her children in horrible captivity, was more

terrible. The story of the little Dauphin is the most pathetic. The Dauphin was placed in solitary confinement, poorly fed and miserably clad, where he finally died at the age of ten years. Historians differ as to the death of this young Prince. Robespierre was the last of the leaders of the Jacobins. He was a thin man, with rasping voice. There was nothing attractive in his appearance. In the Assembly he was for some time of little account; but gradually he made for himself a position, and nice observers noted in him a quality of fanatical earnestness and conviction, in virtue of which they surmised for him a great career. 'This man,' said Mirabeau, 'will go far, for he believes every word he says.' He became a merciless fanatic, with supreme power. He was ready to send to the guillotine his best friends, if they crossed his path. Robespierre, as was natural, had many enemies, and in particular, the numerous friends of Danton were eager to avenge his death. A conspiracy was organized against the tyrant, and after a scene of fierce struggle, his arrest was accomplished. He was struck down in the Hotel de Ville, and as he lay on the table bleeding from his wounds not a hand was stretched out to give him water. The multitude spat upon him and insulted him in every manner possible, but his courage never faltered, and he was taken to the guillotine to suffer the same death which he had brought to so many. When the knife fell that severed his head from his body loud and unanimous were the cheers that went up from the crowd. 'Yes, Robespierre, there is a God,' cried out an old man. But with his death the Reign of Terror did not end. In three days 114 victims suffered death. Finally came Napoleon, the rescuer of the people from impending anarchy. The young man was summoned by the Assembly to take command of the forces to put down the revolution. 'Yes, I am in the habit of accomplishing all that I undertake,' were his words, when questioned as to the success of the enterprise. But he in turn, led on by ambition, founded for a brief time a kind of Roman empire, and he himself became the Cæsar of the Nineteenth Century."

Braddock's Defeat.—The dispute with the French in respect to the Ohio lands, which commenced in Virginia, was vigorously taken up in England, and two regiments were at once ordered to America to maintain the claim of the British Crown to the territory in dispute. These troops arrived in the early part of 1755, under the command of General Braddock, who invited Washington to serve during the campaign as a volunteer aide-de-camp. This invitation he at once accepted, and joined the regiment on its march to Fort Cumberland. At this post the expedition was unfortunately detained until near the middle of June, waiting for teams and army stores, and by the time they were ready to march Washington was prostrated by a serious illness, but, with his characteristic spirit, he refused to remain at the fort, and accompanied the army in a covered wagon. The object of the campaign being to capture Fort Duquesne by a rapid march and possible surprise, Washington advised the general to leave his heavy artillery and baggage behind, and to press forward with a chosen body of troops as expeditiously as possible. This advice being adopted, twelve hundred men were selected, to be commanded by General Braddock in person, and to advance with the utmost dispatch. But much to the disappointment of Washington, the march was not made with the speed or caution the exigencies of the case required. Writing to his brother, Washington said: "I found that instead of pushing on with vigor, without regarding a little rough road, they were halting to level every molehill and to erect bridges over every brook." At

Little Meadows Washington was so overcome by sickness that he had to remain behind for a few days until the arrival of Colonel Dunbar with the remainder of the army. He again reached the main army on the day before that eventful battle in our early history. This was on the 9th of July, when General Braddock, having crossed the Monongahela River, was pressing forward to Fort Duquesne without caution or preparation to prevent surprise. Earnestly Washington expostulated with him and explained to him the peculiar warfare of the wily savage, but to this advice of the colonial militia officer the vain and arrogant Braddock gave a contemptuous reply that he had nothing to fear from French or Indians, and that he commanded British troops whose bravery and tactics were superior to that of any savage foe. Thus he marched his troops on without a single scout until within a few miles of Fort Duquesne, when suddenly they fell into that terrible and deadly ambush so familiar to history as one of the most stupid and obstinate blunders ever made by a military man. Here the hidden foe of French and Indians in the high grass and behind trees poured their deadly volleys of musketry into the broken and disordered ranks, and with dead and dying strewing the ground in every direction, the greatest consternation prevailed, and officers and soldiers alike went down or fled, unable to see or fight their foe. Washington and his Virginia militia alone were cool, and they alone saved the remnant of the British army from entire destruction. Skilled in the Indian mode of warfare, the Virginia troops took to the shelter of the trees, and by their well-directed fire held the savages in check and stopped the relentless pursuit and butchery. Braddock was soon shot down, and the entire defence devolved on Washington, who rode through the hottest of the engagement and had two horses killed under him, and four bullets passed through his coat. It seems indeed a Providential interposition that saved him from the fate of those around him.

Never before was an army more completely surprised in daylight, or thrown into greater dismay or disorder. A thousand deadly bullets were whistling through the forest, and hundreds of panic-stricken soldiers writhed in death agonies. This was the fearful surprise, the awful ambush against which Washington had continually warned Braddock, who had time in his dying agonies, while being carried to the camp of Dunbar, to realize his fatal mistake, if he did not even fully realize it on the field of his terrible defeat, while Washington's heroic deeds upon that bloody field stand out as one of the brightest pages of his renown.

The Plague of London.—The great plague of London in 1665 forms a climax in the history of diseases. Many, with Milton or Defoe, looked upon the plague as the judgment of Heaven upon the misdeeds of their rulers. London in the winter and spring of 1664-'65 was crowded with people; in the West End the wealthy and noble gathered around Westminster and Whitehall, in the city and the eastern suburbs trade had revived. The river was full of ships, the streets filled with an overflowing tide of life. Defoe has painted with his realistic pen the slow rise of the pestilence, the first alarm, the hopes, the fears, the progress of the scourge secretly and then openly, the flight of the citizens, the horrid gloom, the death cries, the yawning graves, crime, woe, the decline of the pestilence, the boundless joy of the survivors, the return of the impenitent Court. For a long time it had been known in London that the plague had been raging on the Continent, brought from the East by some unlucky trader; but in the winter of 1664 only a few cases had been noticed in the capital, yet these were enough

to excite a deep anxiety. But the winter came on sharp and bleak, and seemed to kill the disease, as if it could only flourish in the hot air of summer. It disappeared wholly. It revived in May—a cool, pleasant month; it lingered in the filth and squalor of St. Giles's, and in June broke into fearful activity. The pestilence had come; the citizens who were able closed their houses and shops and fled. The Court had gone to Oxford; for weeks the streets were filled with crowds of people moving to the country on horseback, on foot, carrying their furniture, goods, wares, the rich and poor mingled in a common calamity.

But many were forced to stay, and on these the pestilence fell with almost unaccountable fury. The hot weather of July roused it to virulence; in August it was fearful; in September the horrors told of it surpass belief. It first appeared with a tumor on the breast or under the arm, hard, painful, horrible—the plague-spot. The physicians when they saw the fearful omen would cry, “Lift up your eyes to God!” In a few hours it was fatal. Sometimes the patient sank under a raging fever, headache; sometimes faded away in a swift decline, almost painless; some seemed to die of fright; some hanged themselves to escape it; some were seized in the streets, and died before they could reach their own doors. In September 8,000 persons died weekly, and 60,000 it was believed were infected. The Lord Mayor of the city, his sheriff and aldermen, remained bravely at their post; they did all that man could do. They ordered, when too late, the streets to be purified; funerals—or rather burials—were only to be performed at night, when there was to be no tolling of bells, no outward ceremony. But at night the fatal cart began its rounds, and at every infected house the cry was heard, “Bring out your dead!” They were thrown together in huge piles; in the churchyards deep pits were dug, and here by the gleam of torches the bodies were thrown in and lightly covered with earth.

Every house that was infected was isolated; a watchman stood at the entrance; no one was suffered to go in or out except the physician; upon the door was placed a large red cross inscribed: “Lord have mercy on us.” They might well cry for mercy. The air seemed tainted; grass grew in once crowded streets; the trade of the capital was lost; the ships hung idly in the Thames; the miserable poor died by thousands, and saved the city from the cost of feeding them, which it never has failed to do. The recreant King and Court would fly from the scene of duty, but the city officials showed no trace of fear. The Mayor was constantly in the streets; even the constables and watchmen were seldom at rest; many of them died. Day and night, at last, an observer relates, the labor of burial went on. Sancroft, Dean of St. Paul's, had fled to Tunbridge; his canons remained, and some of their letters to the Dean still exist—the cry of utter despair.

Whole streets of houses were shut up and deserted; men fled from each other when they met; the money paid to the butcher or baker was invariably fumigated; thieves wandered through the deserted shops and dwellings, and sometimes died in them. Fearful tales were told of nurses who smothered and robbed their patients; of deeds of horror that were never punished; of the infected who ran shrieking about the streets, and fell dead; of homes in which all had died together. August, September, passed with growing horrors; in November the colder weather seemed to check the disease, and many who came back too hastily were infected and died. At last in December the great deliverance came; the pestilence had ceased. A wild, a fearful joy spread over the afflicted city; its people came back once

more to the desolate scene, maddened with a strange exhilaration. Those who survived were crazed with the joy of living. Once more the great city was thronged with the rich, busy, gay; the Court and King came back; a rigid law was passed to punish Dissenters; the revels and crimes of Whitehall began again; but nothing was done by Court or King to prevent the return of that awful scourge that had so recently passed away. A mightier power intervened. A new calamity seemed to prevent a recurrence of the old. The great fire of London soon followed, swept over the tainted ground, consumed churches and church-yards—St. Paul's and St. Mary's—shops, warehouses, palaces, hovels, cleansed many a narrow close, purified many a scene of horror. The city was rebuilt with wider streets, better buildings. Perhaps its citizens had learned neatness and propriety; but it is certain that the plague never came again, and that by the labors of modern science the vast capital has been made one of the healthiest and most fortunate of cities.

The Burning of Moscow.—The following graphic description of this thrilling episode in the career of the first Napoleon is extracted from an exceedingly interesting book of travels entitled “Red-Letter Days Abroad,” by John L. Stoddard (Boston: James R. Osgood & Co.):

It was by moonlight on a summer evening that we went forth from our hotel, and, standing near St. Basil's Church, took a farewell look at the Kremlin. Never before had Moscow seemed to me such an Oriental city; for its gilded towers, sparkling in the moonbeams, recalled the Turkish minarets which I had often watched thus from the Bosphorus. I thought then of the night which Napoleon passed within those Kremlin walls—apparently a conqueror, but really on the verge of a sublime catastrophe. “We shall see,” he had exclaimed on entering the Kremlin, “what the Russians will do. If they refuse to treat with me, our winter quarters are assured. We shall give to the world the singular spectacle of an army wintering in an enemy's country. In the springtime will come mild weather and victory!” Napoleon believed that his genius had foreseen everything. It had, indeed, foreseen every possibility, save one, namely, the suicide of Moscow! As the exultant French entered the city which seemed to them the goal of their desires, they found it a desert without food or inhabitants. Even here the Russian army persisted in its policy of retreating and never fighting; for well it knew that in the field the Eagles of France moved only to victory. Its population of three hundred thousand had fled, and only some liberated convicts and abandoned wretches watched the triumphant entry of the conqueror. It was appalling. The French were starving; and Moscow was empty! But this was only the commencement.

Scarcely had Napoleon entered the Kremlin, when the liberated convicts began their work, and those flames burst forth whose lurid after-glow was to light the path to Waterloo and St. Helena. There was something sublime in this act of the Russians. To thwart the otherwise invincible Napoleon, they gave up to the devouring element their ancient, beautiful and holy city, although it was the idol of every Russian heart, and though her shrines were to him the holiest in the world, hallowed by seven centuries of historical association! This fearful sea of flame spoke, therefore, in a million fiery tongues of the grandest sacrifice ever made to national feeling.

Starting from eleven different places, the conflagration raged for three days with terrific fierceness. The Russians had removed all the engines,

and the dismayed French could do almost nothing to check it, though the incendiaries were shot down like dogs. But what words can describe the horror of that scene? Amid the glorious palaces and churches resplendent in the flames, the convicts and abandoned wretches ran like vermin, engaged in universal pillage, and covering their filthy rags with furs and costly robes. What the fire spared, the greedy clutch of ravishers destroyed; and works of elegance and luxury went down either in the awful holocaust or in the vortex of remorseless war. No less than twenty thousand Russian soldiers who had been left in the Moscow hospitals were burned to death.

What wonder that Napoleon, though quartered in the Kremlin, now sought to make peace with his peculiar foe? But now the Russians laughed, and Kutuzoff, their leader, answered: "I have but just opened the campaign, for now I see approaching my ally, Winter!" And then commenced that terrible retreat, whose horrors have baffled the power of brush and pencil to portray. All the annals of war furnish no parallel to the story of that march, which has been forever frozen into the memory of man. The frost and snow made frightful havoc with the host, which in the most awful scenes of carnage had never blanched. Such was their agony for food that officers and soldiers alike fought for the carcasses of the horses as they fell, and ate them raw.

Freezing, yet struggling to the last against the eddying snow and piercing wind, they staggered on, till one after another fell from the ranks, to be confined only in the shroud of ice woven around them by the pitiless storming. The exact extent of the French loss is unknown, but a Russian account states that when the icy mantle of the Beresina had melted in the spring, there were found in the river alone thirty-six thousand dead bodies! They were the last ghastly remnant of the one hundred and thirty thousand who perished on that fearful march, from cold, hunger, and fatigue!

Chronological American History.—923. Discovery of Greenland by the Icelanders.

- 1435. Columbus born at Genoa, in Italy.
- 1492. Oct. 27, Cuba discovered.
- 1494. Columbus discovers Jamaica.
- 1497. Newfoundland and Labrador discovered by the Cabots.
- 1498. Aug. 1, Columbus discovers the South American continent.
- 1499. South America visited by Americus Vesputius.
- 1500. The Amazon at its mouth discovered by Pincon.
- 1512. April 2, Florida discovered by Juan Ponce de Leon.
- 1513. Sept. 26, Pacific Ocean discovered by Vasco Nunez de Balboa.
- 1516. Rio de la Plata discovered by Juan Diaz de Solis.
- 1519. March 13, Cortez lands at Tabasco in Mexico.
- 1520. Magellan discovers Patagonia.
- De Ayllon discovers Carolina.
- 1522. Bermuda discovered by Juan Bermudez.
- 1537. California discovered by Cortez.
- 1539. Ferdinand de Soto heads an expedition to conquer Florida.
- 1541. De Soto discovers the Mississippi.
- 1562. Coligny attempts to found a colony of French Protestants in Florida.
- 1563. Slaves first imported into the West Indies by the English.
- 1565. St. Augustine founded by the Spaniards.
- 1576. Elizabeth's and Frobisher's Straits discovered by Martin Frobisher.

- 1584. Sir Walter Raleigh dispatches two vessels to Virginia.
- 1586. Discovery of Davis's Straits.
- 1602. May 15, Cape Cod discovered and named by Bartholomew Gosnold.
- 1603. Coast of Maine visited by Martin Pring.
- 1605. Port Royal, Acadie [Nova Scotia], founded by the French under De Monts.
- 1608. July 3, Quebec founded by Champlain.
- 1609. Hudson River discovered by Henry Hudson.
- 1610. Delaware Bay named in honor of Lord de la War, who visited the bay at that time and died on his vessel at his mouth.
- 1611. Lake Champlain discovered by Champlain.
- 1613. Pocahontas weds John Rolfe.
- 1614. New York settled by the Dutch on Manhattan Island (now New York) and at Fort Orange (Albany).
- 1616. Tobacco first cultivated in Virginia.
- 1619. June 19, first colonial assembly in Virginia.
- 1620. Slaves first introduced into Virginia by the Dutch.
Nov. 10, the Mayflower anchors in Cape Cod harbor; first white child born in New England.
Dec. 11, landing of the Puritans at Plymouth.
- 1621. May 12, first marriage at Plymouth.
- 1623. Maine and New Hampshire settled by the English. New Jersey settled by the Swedes and Dutch.
- 1627. Delaware settled by Swedes and Finns.
- 1628. Salem, Mass., founded by John Endicott.
- 1629. Charlestown founded by the Massachusetts Bay colony.
- 1634. Maryland founded by Lord Baltimore.
- 1636. Hartford settled. Providence, R. I., founded by Roger Williams.
- 1638. New Haven founded by Eaton and Davenport. Harvard college founded.
- 1639. First printing press set up at Cambridge, Mass., by Stephen Day.
- 1640. Montreal founded.
- 1648. First execution for witchcraft. New London settled.
- 1650. Harvard college chartered. Constitution of Maryland settled.
- 1663. Carolina granted to Lord Clarendon by Charles II.
- 1665. June 12, New York city incorporated.
- 1672. Charleston, S. C., founded. First copyright granted by Massachusetts.
- 1675. June 24, commencement of King Philip's war; attack on Swanzeey.
- 1681. Grant of Pennsylvania to William Penn.
- 1687. First printing-press established near Philadelphia by William Bradford.
- 1693. First printing-press established in New York, by William Bradford.
- 1699. Kidd the pirate apprehended at Boston.
- 1701. Yale College founded at Saybrook. Commencement of Queen Anne's war.
- 1703. Culture of silk introduced into Carolina. Duty of £4 laid on imported negroes in Massachussets.
- 1704. First newspaper (*Boston News Letter*) published at Boston, by Bartholomew Green.
- 1709. First printing-press in Connecticut, set up at New London, by Thomas Short.
- 1710. First colonial post-office at New York.
- 1712. Free schools founded in Charlestown, Mass.

- 1714. First schooner built at Cape Ann.
- 1717. New Orleans founded by the French.
- 1719. First Presbyterian church founded in New York.
- 1721. Inoculation for small-pox introduced into New England.
- 1725. First newspaper in New York (*New York Gazette*), published by William Bradford.
- 1729. North and South Carolina separated.
- 1732. Tobacco made a legal tender in Maryland at 1d. per pound, and corn at 20d. per bushel.
Feb. 22, George Washington born.
- 1733. Georgia settled by Oglethorpe.
- 1738. College founded at Princeton, N. J.
- 1742. Faneuil Hall erected at Boston by Peter Faneuil.
- 1744. King George's war begins.
- 1750. First theatrical performance in Boston.
- 1754. Columbia College in New York founded.
Beginning of the old French war.
- 1755. July 9, Braddock's defeat.
Sept. 8, battle of Lake George.
- 1757. Fort William Henry taken by the French.
- 1759. Niagara, Ticonderogo, and Crown Point taken by the English, in July.
Sept. 13, battle on the Plains of Abraham; Wolf and Montcalm slain.
Sept. 18, Quebec surrenders to the English.
- 1764. April 21, Louisiana ordered to be given up to Spain.
- 1769. Dartmouth College incorporated.
- 1773. Dec. 16, destruction of 342 chests of tea in Boston harbor.
- 1775. Several ships of the line and ten thousand troops ordered to America.
April 19, battle of Lexington.
Congress votes to raise an army of twenty thousand men.
June 15, George Washington appointed Commander-in-Chief of the American army.
June 17, battle of Bunker's Hill.
July 12, Washington takes command of the army at Cambridge.
- 1776. March 17, the British evacuate Boston.
April, Washington removes his army to New York.
June 28, repulse of the British at Charleston.
July 4, Declaration of Independence.
Aug. 27, battle of Long Island; the British victorious.
Washington abandons New York city; the British take possession, Sept. 15.
Oct. 28, battle of White Plains.
- 1777. Lafayette arrives from France with troops and supplies; Congress gives him a Major-General's commission, July 31.
Aug. 16, battle of Bennington.
Sept. 11, battle of Brandywine.
Oct. 17, surrender of the British army under Burgoyne.
- 1778. June 18, the British evacuate Philadelphia.
July 11, arrival of a French fleet under Count d'Estaing.
- 1780. May 12, surrender of Gen. Lincoln and American army at Charleston.
Sept. 23, treason of Gen. Arnold, and arrest of Major Andre.
- 1781. Bank of North America established.
Oct. 19, surrender of Cornwallis and 7,000 troops at Yorktown.
- 1782. April 17, Holland acknowledges our independence.

- 1782. Nov. 30, preliminaries of peace between the United States and Great Britain signed at Paris.
- 1783. Independence of the United States acknowledged by Sweden, Feb. 5; by Denmark, Feb. 25; by Spain, March 24; and by Russia, in July. April 11, peace proclaimed by Congress; April 19, announced to the army by Washington.
Nov. 25, New York evacuated by the British.
- 1786. Shay's insurrection in Massachusetts.
- 1789. George Washington elected President; inaugurated April 30.
- 1793. Washington re-elected President. Death of John Hancock.
- 1794. Insurrection in Pennsylvania.
- 1797. March 4, John Adams inaugurated President.
- 1799. Dec. 14, death of Washington.
- 1800. Seat of government removed to the city of Washington.
- 1801. March 4, Thomas Jefferson inaugurated President.
- 1804. Alexander Hamilton killed by Aaron Burr in a duel.
- 1807. Trial of Aaron Burr for treason. Steamboat invented by Robert Fulton.
- 1808. Jan. 1, the slave trade abolished.
- 1809. March 4, James Madison inaugurated President.
- 1811. Nov. 7, battle of Tippecanoe.
- 1812. June 18, war declared.
- 1813. May 27, battle of Fort George.
Sept. 10, Commodore Perry's victory on Lake Erie.
- 1814. Aug. 25, the British occupy the city of Washington, and burn the Capitol.
Sept. 11, Macdonough's victory on Lake Champlain.
- 1815. Jan. 8, battle of New Orleans.
March, war declared with Algiers.
- 1817. March 4, James Monroe inaugurated President.
- 1819. First steamship sailed for Europe.
- 1821. Gas first used for lighting streets in the United States, at Baltimore.
- 1825. March 4, John Quincy Adams inaugurated President.
- 1829. March 4, Andrew Jackson inaugurated President.
May 2, hail falls in Tuscaloosa, Ala., to the depth of twelve inches.
- 1833. March 4, Andrew Jackson inaugurated President for a second term.
May 16, Santa Anna inaugurated President of Mexico.
- 1835. Dec. 16, great fire in New York.
Seminole war in Florida begun.
- 1837. March 4, Martin Van Buren inaugurated President.
- 1841. March 4, William Henry Harrison inaugurated President.
April 4, Death of General Harrison, John Tyler succeeds to the executive.
- 1845. March 4, James Knox Polk inaugurated President.
June 8, death of Andrew Jackson.
- 1846. May 13, proclamation of war existing with Mexico.
Oct. 25, Tobasco in Mexico bombarded by Commodore Perry.
- 1847. Sept. 14, the American army enters the city of Mexico.
- 1848. Feb. 23, John Quincy Adams expires in the Capitol at Washington.
- 1849. March 5, inauguration of Zachary Taylor as President.
May 15, the cholera breaks out in New York.
- 1850. July 9, death of President Taylor at Washington.
July 10, Millard Fillmore takes the oath of office as President.
Sept. 18, fugitive slave bill passed.

1852. June 29, Henry Clay dies at Washington.
Oct. 24, Daniel Webster dies at Marshfield.
1853. March 4, Franklin Pierce inaugurated President.
July 14, Crystal Palace at New York opened.
1856. May 22, Charles Sumner, Senator from Massachusetts, violently assaulted in the Senate chamber at Washington, by Preston C. Brooks, representative from South Carolina.
1857. March 4, James Buchanan inaugurated President.
1858. Aug. 5, news of the successful laying of the Atlantic telegraph cable is received throughout the country with great demonstrations of joy. The cable was placed in mid-ocean July 29; the *Agamemnon* reached Valencia, Aug. 4, and the *Niagara* Trinity Bay, Aug. 5.
1859. Oct. 6, John Brown's seizure of Harper's Ferry; he is taken, and hung Dec. 2.
1860. May 18, Lincoln nominated by Republican convention at Chicago.
Nov. 6, Abraham Lincoln elected President.
1861. Feb. 4, Seceders' convention at Montgomery, Ala.; they call themselves "Confederate States of America," and adopt a constitution.
Feb. 14, Jeff. Davis made President of the Confederates; they raise troops and arm for war.
April 14, Fort Sumter surrenders after two days' bombardment by the Confederates.
1862. Feb. 1, Gen. Grant takes Fort Donelson with over 13,000 prisoners, after four days of tremendous fighting.
Feb. 22, Jeff. Davis inaugurated rebel President for six years.
May 31, battle of Fair Oaks, McClellan's advance defeated severely by rebels.
June 6, great naval battle in the river before Memphis; rebel fleet nearly annihilated; Memphis surrendered on the same day to Commodore Davis.
July 1, battle of Malvern Hill, last of the Seven Days' Battles; rebels repulsed with great loss, and the position on the James maintained. Total Union losses in seven days, 15,244.
July 1, President Lincoln calls for 600,000 volunteers.
Aug. 29 and 30, Gen. Pope defeated at Bull Run after very heavy fighting, and falls back.
Sept. 16 and 17, battle of Antietam; rebels defeated, losing 25,000.
Sept. 22, Emancipation Proclamation announced for Jan. 1, 1863.
1863. Jan. 1, the definite Emancipation Proclamation issued.
May 1-5, battle of Chancellorsville; indecisive, but great losses on both sides.
July 1-3, battle of Gettysburg; Lee defeated and retreats at once southward.
July 4, unconditional surrender of Vicksburg and 31,000 men to Gen. Grant.
July 13-18, draft riots in New York city, several negroes tortured and hung by mob, and much burning and robbing; 1,300 rioters killed, and riots put down.
Oct. 17, President Lincoln calls for 300,000 more men.
1864. March 17, Gen. Grant assumes supreme command of all the armies of the United States.
May 5-6, the tremendous battle of the Wilderness; resulting in Lee's retiring.

1864. June 7, Mr. Lincoln renominated at Baltimore.
July 16, gold about this time at its highest in New York, viz.: 284 per cent.
Aug. 5, Admiral Farragut's splendid victory, in forcing his way into Mobile Harbor.
Nov. 8, Lincoln and Johnson elected. Gen. McClellan resigns his commission.
1865. April 2, Grant attacks heavily along his whole line; Lee decisively defeated, Petersburg and Richmond evacuated at night, and Davis flees.
April 9, Lee surrenders remains of his army; being 26,115 men.
April 14, Booth assassinates President Lincoln, and his confederate Payne tries to kill Mr. Seward; Mr. Lincoln dies at 7:22 next morning.
April 25, Booth discovered in a barn in Va., and refusing to surrender, is shot and dies in four hours.
May 10, Jeff. Davis captured in female disguise at Irwinsville, Ga.
July 7, the assassins Harold, Payne, Atzeroth and Mrs. Surratt, hung at Washington; Arnold, Mudd, Spangle and McLaughlin imprisoned for life.
Dec. 18, the Secretary of State, Mr. Seward, officially declared slavery abolished throughout the United States, 27 States having ratified the Constitutional Amendment.
1866. July 4, extensive conflagration in Portland, Me.; one third of the city burnt, and property amounting to \$10,000,000.
July 27, laying of the Atlantic cable successively completed.
1868. Nov. 3, Gen. Grant was elected President, and Schuyler Colfax Vice-President.
1871. Oct. 8, commenced and continued for several days, in Chicago, Ill., one of the greatest conflagrations of modern times, in which more than 250 persons lost their lives, and destroyed property to the enormous amount of \$196,000,000.
1876. Centennial anniversary of American Independence.
1877. March 4, Rutherford B. Hayes inaugurated President.
1881. March 4, James A. Garfield inaugurated President.
July 2, President Garfield shot by Charles J. Guiteau at Washington.
Sept. 19, President Garfield died at Long Branch.
Sept. 20, Chester A. Arthur inaugurated President.
1885. March 4, Grover Cleveland inaugurated President.

NATURAL HISTORY.

The Lion.—The lion is chiefly an inhabitant of Africa, although it is found also in some of the wilds of Asia, particularly in certain parts of Arabia, Persia, and India. It is not, in general, an inhabitant of deep forests, but rather of open plains, in which the shelter of occasional bushes or thickets may be found. The breeding-place is always in some much secluded retreat, in which the young—two, three, or four in a litter—are watched over with great assiduity by both parents, and, if necessary, are defended with



THE LION.

great courage—although, in other circumstances, the lion is more disposed to retire from man than to assail him or contend with him. When met in an open country, he retires at first slowly, as if ready for battle, but not desirous of it; then more swiftly; and finally, by rapid bounds. If compelled to defend himself he manifests great courage. He often springs upon his prey by a sudden bound accompanied with a roar; and it is said that if he fails in seizing it, he does not usually pursue, but retires as if ashamed; it is certain,

however, that the lion also often takes its prey by pursuing it, and with great perseverance. The animal singled out for pursuit, as a zebra, may be swifter of foot than the lion, but greater power of endurance enables him to make it his victim. Deer and antelopes are perhaps the most common food of lions. Like the rest of the *Felidæ*, it is a nocturnal animal; its eyes are adapted for the night or twilight rather than for the day. It lurks generally in its lair during the day, and issues as night comes on, when its tremendous roar begins to be heard in the wilderness. It has a horror of fires and torch lights, of which travelers in Africa avail themselves, when surrounded by prowling lions in the wilderness by night, and sleep in safety.

The Hippopotamus.—The common hippopotamus is one of the largest of existing quadrupeds, the bulk of its body being little inferior to that of the elephant; although its legs are so short that its belly almost touches the ground, and its height is not much above five feet. It is extremely aquatic in its habits, living mostly in lakes or rivers, often in tidal estuaries,

where the saltness of the water compels it to resort to springs for the purpose of drinking, and sometimes even in the sea, although it never proceeds to any considerable distance from the shore. Its skin is very thick—on the back and sides, more than two inches; it is dark brown, destitute of hair, and exudes in great abundance from its numerous pores, a thickish, oily fluid, by which it is kept constantly lubricated. The tail is short. The feet have each four toes, nearly equal in size, and hoofed. The neck is short and thick. The head is very large, with small ears, and small eyes placed high, so that they are easily raised above water, without much of the animal being exposed to view. The muzzle is very large, rounded, and tumid, with large



THE HIPPOPOTAMUS.

nostrils and great lips concealing the large front teeth. The hippopotamus cuts grass or corn as if it were done with a scythe, or bites with its strong teeth a stem of considerable thickness neatly through. The skull, while it is distinguished by remarkable peculiarities, corresponds in the most important characters with that of the hog. The respiration of the hippopotamus is slow, and thus it is enabled to spend much of its time under water, only coming to the surface at intervals to breathe. It swims and dives with great ease, and often walks along the bottom, completely under water. Its food consists chiefly of the plants which grow in shallow waters, and about the margins of lakes and rivers. The hippopotamus is lively and playful in its native waters; it soon learns to avoid man, and when it cannot retire among reeds for concealment, it dives and remains long under water, raising only its nose to the surface when another breath becomes necessary. The female hippopotamus may sometimes be seen swimming with her young one on her

back. The animal is generally inoffensive, but is occasionally roused to fits of rage, in which it becomes extremely dangerous, particularly to those who pursue it in boats. Its voice is loud and harsh, and is likened by Burckhardt to the creaking and groaning of a large wooden door.

The Elephant.—For ages mankind have been familiar with the general character of the elephant, the largest animal on the globe; but travelers and naturalists are very frequently discovering new facts in regard to their habits, instincts, and sagacity, which give new interest to the character of that monster. It is now settled that there are several distinct species. Those in equatorial Africa are vastly larger than the variety with which Europeans are mostly acquainted in the East Indies. The first have immensely large pendulous ears, which when thrown back cover the whole of the shoulders, and thus serve an important purpose in fanning and keeping off annoying insects. The others have comparatively small ears, less serviceable as protecting instruments. The African elephant rarely has the two tusks of the same size or length. Ranging about in herds they unite in actively uprooting large trees for the sake of the tender leaves they know are only at the top. While some pry and lift with the right tusk under a resisting root, others push against the trunk and thus heave it over. They are right-handed, like all quadrupeds, as well as man. The right tusk, in consequence of being used most, is not only stouter and larger than the left, but often broken off at the point from misadventure in their foraging operations. Formerly, when large numbers of elephants were trained for war in the neighborhood of Calcutta, long rows of huge fellows having heavy iron chains thirty feet long fastened to a collar, at word of command would suddenly wind them round their trunks and at bidding throw them out horizontally with prodigious force, sweeping down whole platoons of soldiers at once when in close engagement.

The Bear.—The American black bear (*Ursus Americanus*) is found in all parts of North America. Its total length seldom exceeds five feet. The fur is soft and smooth, and generally of a glossy black; but there are varieties of other colors, as the cinnamon bear, the yellow bear, etc. The American black bear usually exhibits a timid disposition, seldom attacks man, feeds chiefly on berries, when they can be obtained, occasionally visits gardens for the sake of cabbages and other vegetables, and strongly prefers vegetable to animal food, but has recourse to the latter when pressed by hunger, and in such circumstances occasionally approaches human habitations and captures pigs, which it endeavors to carry off. In such cases the bear walks on its hind legs, the pig being firmly squeezed between its forepaws and breast, making a noise which frequently leads to a rescue. This and other species of bear, when assailed, not unfrequently hug their adversaries in the manner here described, when their strength renders them very dangerous. The skin of the American black bear is used for caps, rugs, etc., and great numbers are annually killed upon this account, chiefly by the Indians in the employment of the Hudson's Bay Company. The grizzly bear (*U. ferox*) of North America, found chiefly in the Rocky Mountains and the plains to the eastward of them, from Mexico to lat. 61° n., is much larger than the species already noticed, and much more fierce and carnivorous. It sometimes measures more than nine feet from nose to tail, and the claws of the fore-feet more than six inches in length. It has a lengthened and narrowed muzzle, a very short tail, and long grizzled hair. No animal of

the New World is more formidable. It is capable of overpowering the bison, and dragging away the huge carcass. It feeds, however, on fruits and roots. The Arctic or polar bear, also called the white bear (*U. maritimus*), resembles this species in size and fierceness, but is very distinctly characterized by its flat head and comparatively long neck. It has a smooth white fur. It is the only known species of bear which is strictly marine in its habits, never being found far from the sea. It inhabits the most northern shores of Asia and America, Spitzbergen, etc., where it pursues seals, both in the water and upon the ice, and preys upon fishes, birds, etc. Among the articles of its food are eggs and berries in their season, and in confinement it will subsist long on bread and other vegetable food. Like



THE SYRIAN BEAR.

other species of the genus, it displays great affection for its young, and will brave all dangers in their defence. Of other species of bear, the Syrian (*U. Syriacus*) may be mentioned, as perhaps the species particularly intended by the name bear in the Old Testament. It is generally of a dingy-white or brown color, and has a stiff mane of erect hairs between the shoulders. Flocks are not safe from it, yet it more frequently commits ravages on crops of pulse. In its habits generally it much resembles the common bear; as do also the Tibet bear (*U. Tibetanus*), and the spectacled bear (*U. ornatus*), so called from semicircular yellow marks above its eyes, a native of the Andes of Chili. The long-lipped or sloth bear (*U. labiatus*), of the East Indies, is the kind commonly led about by Indian jugglers. Its long hair, short limbs, high back, peculiarly uncouth appearance, and gentleness of disposition, recommend it for this purpose. In a wild state, it is said to feed chiefly on fruits, honey and ants. It possesses in a remarkable degree the power, common in some measures to all the bears, of protruding the lips in order to lay hold of food. Some of the bear species spend the winter in a torpid state, selecting a cavern or the hollow of a tree for hibernation.

The Bison.—The American bison (*Bos Americanus* of some naturalists, *B. Bison* of others) is interesting as the only species of the ox family indigenous to America, except the musk ox of the subarctic regions. It is commonly called *Buffalo* by the Anglo-Americans, although it is very different from the buffaloes of the Old World. It is found in vast numbers in the great prairies between the Mississippi and the Rocky Mountains; it occurs as far north as the vicinity of Great Marten Lake, in lat. 63° or 64°; extensive level and marshy tracts there affording it suitable food, although it is nowhere else to be met with in so high a latitude. Its southern limit appears to be in New Mexico. About 300,000 Indians are supposed to subsist almost entirely on the flesh of the bison. The spear and the bow and arrow are still much employed by them in hunting it, although many of them also use fire-arms. They frequently pursue it on horseback; but the hunter, whether on horseback or on foot, has often much difficulty in getting within shot, upon account of its keenness of scent, and the speed with which it runs. The chase



THE BISON.

of the bison is also very dangerous, as it is apt to turn upon an adversary, and even a fleet horse cannot always escape it. Great numbers, however, are sometimes killed when the hunters can succeed in throwing the herds that are scattered over the plains into confusion, so that they run wildly, without heeding whither. Another expedient of the Indians is to set fire to the grass of the prairies around them, when

they retire in great consternation to the center, and are easily killed. A sort of pound or enclosure is sometimes made, with a long avenue leading to it, and an embankment of snow, such that when the animals have descended over it they cannot return, and by this means great numbers are often captured and killed. Sometimes, also, the Indians contrive to throw them into consternation, and to make them run towards a precipice, over which many of the foremost are driven by the crowds which throng up behind.

The Tiger.—This animal is one of the largest of the *Felidæ*, equal perhaps to the lion in size and strength, and superior in activity. It has no trace of mane. It is more slender than the lion, its whole form more cat-like, its head smaller and rounder. All its motions are performed with the utmost grace and apparent ease. It does not climb trees, but winds its way through brushwood or jungle with great dexterity, runs very swiftly, and can leap an immense distance. It takes its prey either by running, or, more frequently, by lying in ambush and leaping upon it. Its strength is such that it is capable of carrying off an ox or buffalo. It is sometimes fifteen feet in entire length to the tip of the tail; an instance is on record of eighteen

feet; the height is from three to four feet. The tigers of some regions differ considerably in size from those of others; thus the tiger of Bengal is much larger than that of Bokhara. The hair is thick, fine, and shining. The color is a bright tawny yellow, beautifully marked with dark transverse bands, passing into pure white on the under parts; the dark bands are continued as rings on the tail. The tail is long, slightly tapering, clothed with hair similar to that of the body. Individuals sometimes occur, of a pale whitish color, obscurely striped, the stripes only visible in particular lights. The tiger is found only in Asia. It abounds in Hindustan, in the Eastern Peninsula, in Java, Sumatra, and other tropical islands. It is found also in China and Japan, and in Persia. Its range, however, does not extend much to the west of a line drawn from the mouth of the Indus to the Caspian Sea. It is found as far north as the south of Siberia, and even on the banks of the Obi.



THE TIGER.

It inhabits woods, and cannot exist without free access to water. The islands of the delta of the Ganges have long been celebrated as a haunt of tigers. The animal generally lies concealed in a thicket during the day, and seeks its prey by night.

The Jaguar.—The jaguar is one of the largest of the cat tribe, and by far the most powerful and dangerous of the American beasts of prey. It is nearly equal to the tiger in size. The color varies considerably, but is usually a rich yellow, with large black spots and rings, small black spots generally appearing within the rings. A black or very dark-brown variety occurs, but the characteristic markings may be seen in certain lights, deeper in color than the rest of the fur. The jaguar is strong enough to drag away a horse, and swift enough to capture horses on the open pampas. It is chiefly, however, an inhabitant of forests. It climbs trees, however smooth the stem, and moves about with great agility among the branches, making even monkeys its prey. The skins of jaguars are exported from South America in great numbers.

The Leopard.—The leopard or panther is characterized by a peculiar gracefulness, slenderness and flexibility of form, with a very long tail, and spotted fur, the spots being arranged in numerous rows along the sides, and each spot composed of five or six small spots arranged in a circle or rosette. The general color is yellowish; the lower parts lighter; the spots darker than the general color of the fur. The leopard is extremely agile, and possesses the power of leaping, and also that of climbing trees, in great perfection. It haunts wooded places, and is seldom to be found in open regions of long grass, like the tiger. When pursued, it takes refuge, if possible, in a tree, and if hard pressed, springs down on its assailants. It is cunning, and adopts devices similar to those of the fox for carrying on its depreda-



THE LEOPARD.

tions, and concealing its place of retreat. Deer and antelopes are its habitual prey; but it is equally ready to feed on pigs, poultry, or whatever may be found in the vicinity of a farm or village. The size and strength of the leopard render it as dangerous to man as any of the *Felidæ*; but it generally seems to dread and flee from man, unless assailed. It is very capable of domestication.

The Wolf.—The common wolf (*Canis lupus*) inhabits Europe and the northern parts of Asia and America. It is of a yellowish or tawny-gray color, with strong, coarse hair, which is longest on the ears, neck, shoulders and haunches, but particularly on the throat; the muzzle is black, the

upper lip and chin white. The ears are erect and pointed, the muzzle sharp; the legs rather longer than those of the Shepherd's dog; the tail bushy, but not curling; the eyes oblique, giving a peculiar vicious expression to the countenance. The wolf is swift of foot, and hunts deer and other animals, packs of wolves associating for this purpose; it also often commits great ravages among sheep, and attacks calves, but seldom full-grown oxen. It seldom attacks man, unless hard pressed by hunger, when it becomes very dangerous. The hungry wolves which sometimes descend, in severe winters, from the forests of the Alps, Pyrenees, and other mountains, are much dreaded by the inhabitants of neighboring regions; and terrible stories are told of travelers chased by packs of wolves in the forest-covered plains of the east of Europe and in Spain. In general the wolf is cowardly and stealthy, approaching sheepfolds and farm-buildings by night, in search of prey, and readily scared by any demonstration of watchfulness, fleeing from dogs, and not readily exposing itself within range of shot. It defends itself, however, with great vigor, when compelled to do so. It is not easily trapped, being extremely cautious, and appearing to understand the nature and purpose of a trap almost as well as those by whom it is set. Wolves have often been known even to approach a trap so skilfully as to devour the bait without harm to themselves, getting at it from below. The American wolves consist of several distinct species, among which are the gray wolf, dusky wolf, black wolf, white wolf, prairie wolf and coyote.



THE WOLF.

The Giraffe.—The giraffe or camelopard (*Camelopardalis giraffa*), the tallest of quadrupeds, is ranked by some naturalists among deer (*Cervidæ*), but more properly regarded as constituting a distinct family of ruminants, which contains, however, only one species. It is a native of Africa, from Nubia to the Cape of Good Hope, extensively diffused, but apparently nowhere abundant. It occurs generally in some herds of from five to forty. It feeds on the leaves and small branches of trees. Its general aspect is remarkable from the height of the foreparts and great elongation of the neck, the head being sometimes eighteen feet from the ground. The number of vertebræ in the neck, however, is not greater than in other quadrupeds, and it has no extraordinary flexibility, although its form and movements are very graceful. The body is short, and the back slopes from the shoulder to the tail; but the greater height of the foreparts is not owing, as has been often alleged, to the greater length of the forelegs, which are not really longer than the hind legs, but to processes of the vertebræ, which form a basis for the muscular support of the neck and head. The articulation of the skull to the neck is such that the head can be easily thrown back

until it is in the same line with the neck, thus giving the animal additional power of reaching its appropriate food. The skull has empty cavities, which give lightness to the head, along with sufficient extent of surface for the insertion of the ligament which supports it. The legs are long and slender; the feet have cloven hoofs, but are destitute of the small lateral toes or spurious hoofs, which occur in the other cloven-footed ruminants. The head is long; the upper lip entire, projecting far beyond the nostrils, and endowed with considerable muscular power. The tongue is remarkably capable of elongation, and is an organ of touch and of prehension, like the trunk of an elephant; it can be thrust far out of the mouth, and employed to grasp and take up even very small objects; it is said that its tip can be so tapered as to enter the ring of a very small key. The usefulness of such an



THE GIRAFFE.

organ for drawing in leaves and branchlets to the mouth is obvious. The giraffe adroitly picks off the leaves of acacias and other thorny plants, without taking the thorns into its mouth. The dentition of the giraffe agrees with that of antelopes, sheep, goats and oxen; the upper jaw of the male is destitute of the canine teeth, which are present in the male of most kinds of deer. The head is furnished with two remarkable protuberances between the ears, generally described as horns, but very different from the horns of other ani-

mals, and each consisting of a bone united to the skull by an obvious suture, permanent, covered with skin and hair, and terminated by long hard bristles. There is also a projection on the forehead. The ears are moderately long; the tail is long, and terminates in a tuft of long hair that nearly reaches the ground. There is a callosity on the breast. The neck has a very short mane. The hair is short and smooth; the color is a reddish white, marked by numerous dark rusty spots. The eye of the giraffe is very large and lustrous, and so placed that the animal can look all around without turning its head, so that in a wild state it is not easily approached. Its nostrils have a muscle by which they can be closed, a provision for excluding particles of sand. It is an inoffensive animal and generally seeks safety, if possible, in flight, although it is capable of making a

stout resistance, and is said to beat off the lion. It fights by kicking with its hind legs, discharging a storm of kicks with extraordinary rapidity. It is not easily overtaken even by a fleet horse, and has greatly the advantage of a horse on uneven and broken ground. Its pace is described as an amble, the legs of the same side moving at the same time.

The Zebu.—The zebu, Indian ox, or Brahmin ox, is closely allied to the common ox, of which naturalists generally regard it as a mere variety, although some think it a distinct species (*Bos Indicus*). The most conspicuous distinctive character is a large fatty lump on the back, above the shoulders. The legs are rather more slender and delicate than in the European ox. The hump attains a very great size in animals plentifully supplied with food, and not compelled to work; in those which are ill-fed or hard-worked, it is comparatively small. It is alleged that intermixture takes place freely with the common ox, and that there is no difference of



THE ZEBU.

anatomical structure, but these statements require verification. Mr. Vasey found the number of caudal vertebræ in the zebu to be only eighteen, whilst in the common ox it is twenty-one. The zebu is diffused over India, China, the Asiatic Islands, Madagascar, and the east coast of Africa. There are many breeds, differing very much in size; the largest being larger than any oxen of Europe, whilst the smallest are not much larger than a large mastiff. The hump of the largest breeds is said to be sometimes fifty pounds in weight. English residents in India esteem the hump as delicious for the table. There are hornless breeds; but most of the breeds have short horns. There is a breed with two fatty humps, one placed immediately behind the other, which is common in the vicinity of Surat. The voice of the zebu resembles the grunting of the yak, almost as nearly as the lowing of the ox. The zebu is used in India both as a beast of draught and of burden. It is yoked in the plough, and is occasionally used for riding. It can travel from twenty to thirty miles a day, and is very gentle and docile.

The Ant-Eater.—The ant-eater is a genus of South American quadrupeds. They are perfectly toothless, their food being insects, and particularly ants, which they procure in great numbers by thrusting among them a very long cylindrical tongue, covered with a viscid saliva, and then retracting it into the mouth. The head is remarkably elongated, with a slender muzzle, and a small mouth. The tongue is doubled up in the mouth when not in use for catching prey. The ears and eyes are very small. The toes differ in number in the different species, but are united as far as the base of the claws, which are very large and strong, adapted to tearing up the habitations of ants. The great ant-eater (*M. jubata*), a native of the warm parts of South America, and called in Demerara the ant bear, is about four and one-half feet in length from the snout to the origin of the tail, which is more than two feet long, and is covered with very long hair. The



THE ANT-EATER

body is also covered with long hair, particularly along the neck and back. There are four claws on each fore foot, and five on the hind ones. The ant-eater spends much of its time in sleep, the long snout concealed in the fur of the breast, the hind and fore claws locked together, and the bushy tail thrown over all, as if for a shade from the sun. It is very unsocial in its habits, and is regarded as a very stupid animal. It has great strength in its fore-legs and claws, and is said to hug like the bear, so as to crush an enemy to death. The female produces one young one at a birth, and carries it about for some time on her back.

The Porcupine.—The porcupine is a native of the south of Europe, of many parts of Asia, and of most parts of Africa. It is one of the largest of rodents, being from two to three feet in length, besides the tail, which is about six inches long. The hinder part of the head and the neck are furnished

with a crest of long bristles, capable of being elevated or depressed at pleasure. The muzzle and limbs are covered with very short hair; the back and sides with spines, which are longest on the middle of the back, where they are almost of the thickness of a goose quill, and more than a foot long. The spines are supported by a slender pedicle, and they terminate in a sharp point; they are longitudinally striated, and are ringed with black and white, which gives a general gray color to the animal. Their ordinary position is flat, with the points directed backwards; but when the animal is excited, they are erected, and it rolls itself up like the hedgehog, with spines pointing in every direction. The tail spines or quills are of very singular structure, being open thin-sided tubes, about two inches long, supported upon slender flexible pedicles; and they make a sound by



THE PORCUPINE.

rattling together when the tail is shaken. The porcupine is said to rattle also the spines of its body when irritated, but this is doubtful. The statement has been often made, that it throws off its spines or quills by a voluntary act, launching them at its adversaries; but it has no such power, although it is possible that quills ready to come off may be detached in moments of excitement, and fly to a small distance with sufficient force to be annoying to a pursuer. The porcupine's armor is strictly defensive, and it seeks to turn its back, and thus the points of its spines, to an enemy. It is a solitary and nocturnal animal. It burrows in the ground, and in winter it becomes torpid. It feeds on roots, bark, fruits, and other vegetable substances, sometimes committing great depredations in gardens. The spines or quills of the porcupine are used for various purposes, and have a certain commercial value. It is chiefly sought on account

of them; although its flesh is eaten, and was brought to the market of ancient Rome.

The Hedgehog.—Among the smaller mammalia the hedgehog is by no means one of the least interesting, whether we consider its structure or its habits. In almost every part of the country this little animal is common, frequenting woods, copses, orchards and dense hedge-rows, where it lies concealed from morning till dusk, evening being its “opening day,” when it rouses up from slumber and begins its prow for food, when it is all alertness, and alive to every sound. When surprised it makes no attempt to escape by flight, but rolling itself up into the form of a ball, trusts to its panoply of thorns, and awaits the result. While



THE HEDGEHOG.

in this position, the head, legs, and tail are completely hidden and protected, and the animal may be rolled about, or even roughly treated, without being made to unfold itself; nay, the more severely it is attacked, the more pertinaciously does it maintain its defensive form, and the more firmly does it contract. Thus does it offer a passive resistance, and often a successful one, to its enemies, of which the fox is among the most resolute, and to which, in spite of all its efforts, it often falls a prey. When taken young the hedgehog may be completely tamed and made familiar, allowing itself to be handled, and associating with the dog or cat upon terms of perfect concord. It feeds indifferently upon bread and milk, meat, etc., and keeps up a regular nocturnal chase after insects.

The Elk.—The elk, moose, or moose deer, the largest existing species of the deer family, is a native of the northern parts of Europe, Asia and America. When full grown, it is about six feet in height at the shoulders, and sometimes weighs 1,200 pounds. The body is round, compact and short; the neck is short and thick, unlike that of deer in general, but thus adapted for sustaining the great weight of the head and horns. The head is very large, narrow, about two feet long. The horns in males of the second year are unbranched, not flattened, and about a foot long, as the animal becomes older, they begin to display a blade, with more numerous snags, and in mature elks the blade becomes very broad, the snags sometimes fourteen on each horn; a single antler has been known to weigh about sixty pounds. The horns have no basal snag projecting forwards. The ears are long, and have been compared to those of the ass. The eyes are small. The limbs are long, and very graceful. The tail is only about four inches long. The body is covered with coarse angular hair, which breaks when it is bent.

On the neck and withers there is a heavy mane; and the throat is covered with long hair. A large goitre-like swelling under the throat of the younger elks has a very curious appearance. The hoofs of the elk, like those of the reindeer and of the buffalo, are so constructed as to part widely, and to afford a better footing on soft marshy ground or on snow; they make a clattering when it runs. In running it carries its muzzle forward, with the horns thrown back upon the neck so that they may not be caught by branches. Its shoulders being higher



THE ELK.

than the croup, its common gait is a shambling trot; but it can also gallop with great rapidity. Elks delight in marshy districts and in forests. When compelled to eat grass, they must get down on their knees to reach it; their proper food consists of the branches and foliage of shrubs and trees. They are very timid and inoffensive, except during the rutting season. A single stroke of an elk's fore-foot is sufficient to kill the strongest dog. It is also an extremely wary animal, and is with the greatest difficulty approached by the hunter. Its sense of smell is very acute, and the slightest sound excites its alarm. It is, however, much sought after in North America. In Sweden its destruction is prohibited; and in Norway is placed under legal restriction. The flesh of the elk is esteemed a good kind of venison; the fat is remarkably soft; the nose and the tongue are reckoned delicacies. The elk is easily domesticated, and was at one time employed in Sweden for conveying couriers, being capable of traveling more than two hundred miles in a day when attached to a sledge.

identical with the European reindeer, it has never yet been brought under the sway of man, and trained to carry his goods or draw his sledges. Should it be employed for these purposes, it would be a most valuable servant, for it is a very strong as well as an enduring animal, leading its pursuers a chase of four or five days, and often eventually making good its escape. Whenever practicable, the caribou makes for the frozen surface of the lakes, and is then sure to escape, although the manner of doing so is ludicrously clumsy. Rushing recklessly forward, the caribou will be suddenly startled by some object in its front, and on attempting to check its onward career, falls on the ice in a sitting posture, and in that attitude slides



THE CARIBOU, OR AMERICAN REINDEER.

for a considerable distance before it can stop itself. Recovering its feet, it then makes off in another direction, and gets over the ground with such celerity, that the hunters always yield the chase whenever the animal gets upon the ice.

The Beaver.—This interesting quadruped is very widely distributed in the northern regions of the world, reaching in America almost as far south as the Gulf of Mexico. It once existed in the British islands, where, however, it has long been extinct; and it has become rare in Europe, in many parts of which it was once common. It has become rare also in the United States, disappearing before man; but is nowhere so abundant as in

that wide region of lakes and rivers which lies to the north and west of the settled parts of North America. Considerable numbers of beavers are found on the banks of the Obi and other rivers of Siberia, and in Kamtchatka.

The beaver is usually at least two feet in length, from the nose to the root of the tail; the tail is of an oval form, about ten inches in length, fully three inches in greatest breadth, and scarcely an inch in thickness. These dimensions are sometimes exceeded. The general form of the animal is thick and clumsy, thickest at the hips, and then narrowing abruptly, so that it seems to taper into the tail. The head is thick and broad, the nose obtuse, the eyes small, the ears short and rounded. The fur consists of two kinds of



BEAVERS.

hair; the longer hair comparatively coarse, smooth, and glossy; the under coat dense, soft, and silky. The color is generally chestnut, rarely black, spotted, or nearly white. The beaver is very aquatic in its mode of life, and it seldom wanders far from some lake or river. In consequence of its habits, it is also limited to wooded districts, and the northern range of the species is everywhere terminated by the limits of the wood upon the river banks.

The food of the beaver consists of the bark of trees and shrubs (birch, poplar, willow, etc.), and of the roots of water lilies and other aquatic plants. In summer, it eats also berries, leaves, and various kinds of herbage. There is reason to think that it never, as has been supposed, kills or eats fish. Like some other rodents, it lays up stores of provisions for winter; but these, in the case of the beaver, consist chiefly of bark, or of branches, and even

The Stag.—The stag or red deer is a species of deer with round antlers, which have a snag at the base in front. The female has no horns, and is called a *Hind*. The young male, during the first year, acquires mere knobs in place of horns. In the second year, they are longer and pointed, when the animal is called a *Brocket*. The branching of the horns increases every year till the sixth, when the name *Hart* begins to be applied. After this, the age is no longer indicated by an increased number of branches, but the antlers become larger and thicker, their furrows deeper, and the *burr* at the base more projecting. The oldest stags have seldom more than ten or twelve branches, although an instance has occurred of thirty-three on each antler. A fine stag is four feet or more in height at the shoulder. The color is reddish brown in summer, the rump pale; in winter, it is brownish gray. The female is smaller than the male. The young is at first spotted with



THE STAG.

white. The stag feeds on the buds and young shoots of trees, and on grass; or, in the severe weather of winter, on bark and mosses. Its speed is very great. It has also great powers of swimming, and has been known to swim ten miles. When hard pressed by hunters, it turns to bay, and is not approached without danger. At the pairing season, which is in August, even tame stags become so excited that it is not safe to approach them. Their domestication is never very complete. In fighting, it uses not only its horns, but its fore-feet, with which it gives severe blows to an adversary.

The Chamois.—The chamois is a species of antelope inhabiting the Alps and other high mountains of Central and Southern Europe, and is about the size of a large goat. Its color is brown, deeper in winter than in summer. The usual summer resort of the chamois is in the higher regions of the mountains which it inhabits, not far from the snow-line, and it is often to be seen lying on the snow. In winter, it descends to the higher forests. The aromatic and bitter plants of the mountain pastures are its favorite

food. It is like the ruminants generally—very fond of salt; “and many stones are met with in the Alps, hollowed out by the continual licking of the chamois, on account of the saltpetre with which they abound.” It is gregarious; flocks of one hundred are sometimes seen; but in the Swiss Alps, where the numbers have been much reduced by hunting, the flocks are generally very small, and often consist only of a few individuals. Old males often live solitarily. The chamois produces one or two young at a birth, in the month of March or April. It is an animal of extraordinary agility, and flocks may often be observed sporting in a remarkable manner among the rocky heights. It can leap over ravines of sixteen to eighteen feet wide; a wall of fourteen feet high presents no obstacle to it; and it passes readily



THE CHAMOIS.

up or down precipices which almost no other quadruped could attempt. It is said to descend obliquely almost perpendicular precipices of more than twenty feet, striking its feet once or twice against the rock, as if to stay and guide its descent, and alighting securely, often on a very narrow ridge of rock, with its hind feet first, and bringing the fore-feet almost into contact with them. When a flock of chamois is feeding one is always on the watch, and by a sort of whistle announces apprehended danger. From its skin [is made the *shamoy* leather so much prized for its warmth and softness.

The Caribou, or American Reindeer.—The eyes of the reindeer are very quick, and his hearing also acute; but his sense of smell is more wonderfully developed than either of the other senses. The caribou, or American variety of the reindeer, is a large animal, measuring three feet six inches in height at the shoulders when adult. Although it is specifically

trunks of trees. Its extraordinary powers of gnawing are exerted to cut down trees of several inches in diameter, both for food and for the construction of those houses and dams which have rendered it so much an object of admiration to mankind. A tree of eighteen inches in diameter has been found thus cut down by beavers, although smaller ones are usually preferred; and when a tree of this size is cut, the branches only, and not the trunk, are employed in the architectural operations of the animals. These operations are very wonderful, although the statement, at one time commonly made, that beavers drive stakes into the ground, has no foundation in fact; and some of the other particulars which passed current along with it, were equally fabulous. The houses or lodges of beavers are grouped together near the edge of the water, the mud being scraped away from the front, so that there may be a sufficient depth of water there to allow free egress, even during the most severe frost. The winter stores of the animals, consisting of piles or heaps of wood, are also always under water, at such a depth that they cannot be locked up in ice. When the depth of water is not sufficient, the beavers construct a dam across the stream, by the side of which the lodge is placed; the dam is sometimes as much as three hundred yards in length, convex towards the current, and most convex in the strongest currents, sometimes extending on both sides beyond the natural channel of the stream. The materials of which it is composed are sticks, roots, and branches, with stones, moss, grasses, and mud, strangely commingled, but in such a manner that the structure becomes absolutely water tight. Branches, of which the bark has been used for food, or taken off for winter provender, are very generally employed for building purposes. In their building, beavers interlace small branches with each other and with the larger; and a beaver kept in confinement has been known to manifest this instinct, by interlacing branches with the bars of its cage, while it also filled the interstices with carrots, and other vegetables, given it for food, nicely bitten to the proper size, and packed in snow, to protect itself from the cold. Beaver dams are built with the sides inclining towards one another, so that although ten or twelve feet wide at bottom, they have a narrow top. The dams and houses are annually repaired, before winter comes on, the work being performed by night. "In places," says Hearne, "which have been long frequented by beavers undisturbed, their dams, by frequent repairing, become a solid bank, capable of resisting a great force, both of water and ice; and as the willow, poplar, and birch generally take root and shoot up, they by degrees form a kind of regular planted hedge, which I have seen in some places so tall that birds have built their nests among the branches." A broad ditch is often dug all around the lodge, so deep that it cannot freeze to the bottom, and into it the beavers make the holes by which they go out and bring their food. The larger lodges are, in the interior, about seven feet in diameter, and between two and three feet high. The top is formed of branches of trees, matted with mud, grass, moss, etc. The walls are very thick, and the whole structure not only secures much warmth, but is a sufficient protection from wolves, wolverines, and other beasts of prey. Different apartments have often one common roof, but they have usually no internal communication. The sleeping-places of the animals are around the wall of their lodge, the center being left free; they are formed merely of a little grass or tender bark of trees. A single house seldom contains more than ten or twelve beavers, but many such families are often congregated in one place. Beavers, both in a wild state and in confinement, are scrupulously cleanly in their habits.

Beavers often sit on the hind-feet and tail, and eat in this posture, holding up the food in their fore-paws. They also walk on the hind-feet, with support of the tail, when they carry materials to their buildings, except branches, which are dragged. They have considerable power in the tail, and not unfrequently flap it, which has given rise to an opinion, perhaps not altogether erroneous, that they use their tails for plastering their buildings, or beating and adjusting the mud which is employed in them. Beavers do not usually eat in their lodges, but in holes or burrows in the bank of the river, the entrance to which is from beneath the water, and which thence proceed obliquely upwards, often a distance of many feet. To these holes the beavers also flee when their lodge is broken up; and it is therefore a



THE FERRET.

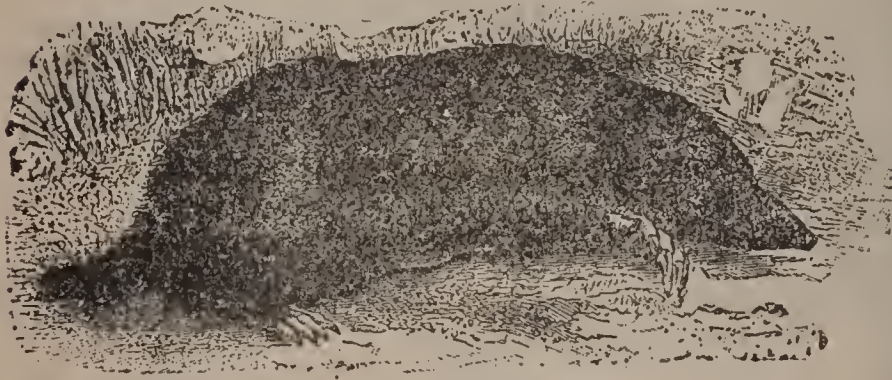
common practice of the beaver hunters to break up the lodges, that they may take the animals in their holes or vaults. Beavers are also taken by nets and traps.

It is chiefly in winter that beavers congregate together. During summer they wander about a little. The young are generally produced in April or May, from two to seven at a birth. Their eyes are open when they are born. Single beavers are frequently met with, which live apart from all others of their species. All of these are males, which, it is supposed, have been conquered and driven away by others of their sex. The beaver is very easily tamed; but no wooden cage will keep one confined. Except in the extraordinary building instincts already noticed, the animal exhibits no remarkable sagacity. The use of the beaver's fur for making hats is well known.

The Ferret.—This animal was imported into Europe from Africa, and was well known to the Romans, being anciently employed, as it still is, in catching rabbits, for which purpose it is often sent into their burrows muzzled, or “coped,” by means of a piece of string, to drive them out into nets,

or, with a string attached to it, it is allowed to seize a rabbit in the burrows, and is then drawn out, holding it fast. The usual plan, however, is to let the ferret have free range of rabbit-holes unmuzzled, the rabbits being shot as they bolt. Attention to warmth and cleanliness is essential to the health of ferrets. They are capable only of partial domestication, acquiring a kind of familiarity with man, and submitting with perfect quietness to his handling, but apparently never forming any very decided attachment; and they never cease to be dangerous if not carefully watched, especially where infants are within their reach. If allowed any measure of freedom, they are ready to attack poultry, and kill far more than they can devour, merely sucking the blood. They generally breed twice a year, each brood consisting of six or nine. The female sometimes devours the young ones, in which case another brood is speedily produced.

Moles.—The mole is a miner, living an almost exclusively subterranean life, even pursuing its prey through the soil, and working out long galleries in the chase. It would appear that its labors are exerted in the accomplishment of very different objects. Each mole may be said to have its own district or manor, its hunting-ground, and its lodges; and this ground is



THE MOLE.

traversed by high-road tunnels, in which it travels from one part to another, all branching off from a central fortress—its ordinary residence, which is not, however, only distinct, but

often remote from the chamber in which the nest is made and the young reared. We will begin by describing the fortress, or ordinary domicile. This fortress is constructed under a hillock of considerable size (not one of those which we ordinarily see, and which, thrown up every night, indicate its hunting excursions). This hillock is raised in some secure place, where a high bank, the roots of a tree or the base of a wall, afford protection. The earth forming this mound is well compacted together, and made solid by the labors of the architect; and within this firm-set mound is a complex arrangement of galleries, and passages of communication. First, a circular gallery occupies the upper portion of the mound, and this communicates, by means of five descending passages, with another, and with a gallery at the base of the mound, and enclosing a larger area. These passages are nearly at equal distances. Within the area of this lower gallery is a chamber, not immediately communicating with it, but with the upper gallery, by three abruptly descending tunnels, so that to get into the basal gallery the mole has first to ascend to the top gallery, and from that descend into the lower gallery. This chamber is the dormitory of the mole. From the basal gallery opens a high-road tunnel, which is carried out in a direct line to the extent of the manor over

which the individual presides, and from the bottom of the central chamber a passage descends, and then sweeping upward joins this main road at a little distance from the hillock, so that the mole can enter the high-road; eight or nine other tunnels are carried out from the basal gallery; they are of greater or less extent, and wind round more or less irregularly, opening into the high-road at various distances from the hillock; these irregular tunnels the mole is continually extending in quest of prey, throwing up the soil above the turf, through holes which it makes for the purpose, and which form the ordinary mole hills which we often see crowded thickly together. The high or main road exceeds in diameter the body of the mole, and is solid and well trodden, with smooth sides; its depth varies, according to the quality of the soil, instinct directing the little excavator in his work. Ordinarily it is five or six inches below the surface, but when carried under a streamlet or pathway it is often a foot and a half beneath. It sometimes happens that the mole will drive two or more additional high-roads, which will not admit of two passing at the same time; one therefore must retreat, but when two males thus come into collision they frequently attack each other, the weaker falling a victim in the combat. The alleys opening from the sides of the high-road are generally inclined downward with a gradual slope, and then at the termination of these the mole excavates branch alleys, upheaving mole hills as it works onward in pursuit of prey. This, however, is not invariably the case, but rather where prey is abundant in rich soils. Where the soil is barren the mole is constantly driving fresh alleys; these in winter are carried deep down to where the worms have pierced their way beyond the line to which the frost penetrates; for, be it observed, the mole does not hibernate, but is as active during winter as in spring or summer, though the results of his operations are less manifest. In soft rich soils, where the worms are among the roots of the turf, the mole, as may be often noticed, drives very superficial runs in the pursuit of them; these runs are to be seen where a thin layer of richly manured soil overlays a stratum of gravel; in fact the depth of these alleys is always determined by the quality of the soil and consequent situation of the worms. With respect to the nest of the female, it is generally constructed at a distance from the fortress, where, at some convenient part, three or four passages intersect each other; this point of convergence is enlarged and rendered commodious, and fitted to receive a bed made of dry herbage, fibrous roots, etc. The chamber is generally beneath a large hillock, but not always; and the surrounding soil is usually such as to afford abundant food to the female with little trouble on her part. The mole breeds in the spring, mostly in April, and brings forth four or five young at a birth. These are supposed to remain under the mother's care till about half grown, when they commence an independent existence.

Baby Monkeys.—Monkeys are born in almost as helpless a condition as are human beings. For the first fortnight after birth they pass their time in being nursed, sleeping, and looking about them. During the whole of this time the care and attention of the mother are most exemplary; the slightest sound or movement excites her immediate notice; and, with her baby in her arms, she skillfully evades any approaching danger by the most adroit manœuvres. At the end of the first fortnight the little one begins to get about by itself, but always under the mother's watchful care. She frequently attempts to teach it to do for itself, but never forgets her solicitude for its safety, and at the earliest intimation of danger seizes it in her arms

and seeks a place of refuge. When about six weeks old the baby begins to need more substantial nutriment than milk, and is taught to provide for himself. Its powers are speedily developed, and in a few weeks its agility is most surprising. The mother's fondness for her offspring continues; she devotes all her care to its comfort and education, and should it meet with an untimely end, her grief is so intense as frequently to cause her own death. "The care which the females bestow upon their offspring," says Duvancel, "is so tender and even refined, that one would be almost tempted to attribute the sentiments to a rational rather than an instinctive process. It is a curious and interesting spectacle, which a little precaution has sometimes enabled me to witness, to see these females carry their young to the river, wash their faces in spite of their childish outcries, and altogether bestow upon their cleanliness a time and attention that in many cases the children of our own species might well envy. The Malays indeed related a fact to me, which I doubted at first, but which I believe to be in a great measure confirmed by my own subsequent observation; it is, that the young *siamangs*, while yet too weak to go alone, are always carried by individuals of their own sex; by their fathers if they are males, by their mothers if females." M. d'Osbonville states that the parents exercise their parental authority over their children in a sort of judicial and strictly impartial form. "The young ones were seen to sport and gambol with one another in the presence of their mother, who sat ready to give judgment and punish misdemeanors. When any one was found guilty of foul play or malicious conduct toward another of the family, the parent interfered by seizing the young criminal by the tail, which she held fast with one of her paws till she boxed his ears with the other."

The Diamond Rattlesnake.—Of all the snake varieties of which we have yet any knowledge, the diamond rattlesnake, as it is called, seems to be most deadly. It grows to a length of six or seven feet, and is somewhat thicker than a man's wrist. It is armed with the whitest and sharpest of fangs, nearly an inch in length, with cisterns of liquid poison at their base. A terror to man and beast, he turns aside from no one, although he will not go out of his way to attack any unless pressed by hunger. A description of his movements by a traveler who has encountered him states that he moves quietly along, his gleaming eyes seeming to emit a greenish light, and to shine with as much brilliancy as the jewels of a finished coquette. Nothing seems to escape his observation, and on the slightest movement near him he swings into a fighting attitude, raising his upper jaw and erecting his fangs, which in a state of repose lie closely packed in the soft muscles of the mouth. This snake is not so active as the famous copperhead of North America, nor so quick to strike, but one blow is almost always fatal. His fangs are so long that they penetrate deep into the muscles and veins of his victim, who has little time for more than a single good-by before closing his eyes forever. In one instance the fangs were found to be seven-eighths of an inch in length, and though not thicker than a common sewing needle, they were perforated with a hole through which the greenish-yellow liquid could be forced in considerable quantities, and each of the sacs contained about half a teaspoonful of the most terrible and deadly poison.

The Crocodile.—This reptile may be described as lizard-like in form, with a great gape, indicative of their characteristic voracity, and with the tail flattened at the sides, so as to become a powerful organ of propulsion in

water. The fore-feet have five toes, the hinder-feet four, the three inner ones only being armed with claws; the feet are more or less webbed. Each jaw has a single row of numerous large teeth, which are conical and directed backwards; planted in distinct sockets, and becoming hollowed at the base, to admit the crowns of the new and larger teeth which are to succeed them as the animal increases in size. Small ribs are attached to the vertebræ of the neck, which give it a peculiar stiffness, and make it difficult for the animal to turn; and persons pursued by crocodiles may make their escape by rapid turning. The eggs of the crocodile are hard, and small in comparison with the size ultimately attained by the animal itself. The females of some, if not of all the species, guard their eggs, and take care of their young;



THE CROCODILE.

although the eggs, buried in the sand or mud, are hatched by the heat of the sun alone. Crocodiles swallow stones, apparently to assist digestion. They prey on fishes and warm-blooded animals; most of them seem to prefer food in a state of incipient putrefaction, and they are even said to hide their prey, and to return to it when it has reached this state. Some of the larger kinds do not scruple to attack man. All crocodiles are large reptiles; they are found in fresh waters and estuaries in the warm parts of the world; none are found in Europe, nor, as far as is yet known, in Australia. The crocodile of the Nile is of a bronzed green color, speckled with brown, lighter beneath, and is sometimes thirty feet long. It often seizes human beings for its prey. In "Park's Travels," an instance is recorded of a negro, one of his guides, who was thus seized in the Gambia, and escaped by thrusting his fingers into the crocodile's eyes. The ancient Egyptians held it sacred, and being exempted from all danger on the part of man, it became more bold and troublesome. The individuals particularly selected as the objects of idolatrous worship were tamed, and took part in religious processions.

The Alligator.—Alligators differ from crocodiles in the shorter and flatter head, the existence of cavities or pits in the upper jaw, into which (and not into mere notches between the teeth, as in the crocodiles) the long fourth teeth of the under jaw are received, and the much less webbed feet. Their habits are less perfectly aquatic; they frequent swamps and marshes, and may be seen basking on the dry ground during the day, in the heat of the sun. They are most active during the night, and then make a loud bel-
lowing. They have great strength in their tails, with which the larger ones can easily upset a light canoe. They feed chiefly on fish, but do not object to other animal food. The females lay their eggs, from twenty to sixty in number, in the mud, and leave them to be hatched by the sun, but keep watch over the spot, and show much affection for their young ones, many



THE ALLIGATOR.

of which, however, fall a prey to the old males, and to vultures and fishes. There are several species, varying from two to twenty feet and upwards in length. Perhaps the most fierce and dangerous is that found in the southern parts of the United States, as far up the Mississippi as the Red River. In cold weather, these animals bury themselves in the mud, and become so torpid, that they may be cut to pieces without showing signs of sensibility; but a few hours of bright sunshine are enough to revive them. Like the other species, they are so protected by their mailed plates that they are not easily killed, except by a shot or blow over the eyes. A very strong kind of leather is prepared from the skin, which is used for making saddles and other articles. It is said that a considerable quantity of oil can be extracted from an alligator, which is transparent and burns well. Alligators are not known to exist in any quarter of the world except America, in which, however, crocodiles are also found. The flesh of alligators is eaten by Indians and negroes. It has a musky flavor. The origin of the name is uncertain, but it is supposed to be a corruption of the Portuguese *lagarto*, a lizard.

Bats.—Sixteen or seventeen distinct species of bats are natives of the British Islands. Of these, however, several are extremely rare and restricted to certain localities; but some, as the *pipistrelle*, or common bat, and the long-eared bat are everywhere abundant. Of all the mammalia the bats alone emulate in their aerial endowments the feathered tenants of the sky; they are essentially flying insectivora. In the air they pass the active period of their existence, and revel in the exercise of their faculties. Their organs of flight, admirably adapted for their destined purpose, do not consist, as in the bird, of stiff feathers based upon the bones of the forearm, but of a membranous expansion stretched over and between the limbs, and to which the bows of the limbs, especially those of the elongated fingers, serve the same purpose as the strips of whalebone in an umbrella. This apparatus



THE LONG-EARED BAT.

can be folded up, and the limbs employed in progression on the ground; on a level surface, however, the bat shuffles awkwardly but quickly along. In the hollows of decayed trees, in the crevices of mouldering masonry, or in the rough chinks and fissures, it can crawl and climb about with tolerable rapidity, as also about the wire work of a cage. It is a smooth and level surface that most embarrasses the bat, but even then it can easily take wind. In the air the bat is all alertness—it is here that these singular creatures pursue their prey—uttering their short, sharp cry as they wheel in circling flights, or perform their abrupt and zig-zag evolutions. The bat is a twilight and nocturnal Rambler; it passes the day in its retreat suspended head downward, clinging to any roughness or projection by the claws of its hinder feet. In this position it hibernates in a state of lethargy, numbers congregating together. Church-steeple, hollow trees, old barns, caverns, and similar retreats, are its lurking places; and numbers are often found crowded together, and forming a compact mass.

The Colugo.—The colugo is a curious bat-like animal, which may be found in Java, Sumatra, and Borneo. It has a membrane from the neck to the end of the tail, which, being attached to the ends of the four limbs, plays the part of wings, permitting the animal to sustain itself in the air for even a longer time than the flying squirrels. The colugos hide themselves during the day in the most lonely parts of the forests, and come forth at evening in search of food. They are then seen moving actively among the trees, either climbing or flying. Their flight is noiseless, and it is said that they can clear a space of some hundreds of yards. They feed on insects, fruits and small birds. In order to rest, these animals suspend themselves by their hind paws to the branches of trees, like bats. The natives of the



THE COLUGO.

countries they inhabit choose this time for capturing them. They are in need of their flesh for food.

Frogs.—The peeping frog is totally different from the “creaking” frog, and well repays one’s attention. It is commonly thought to be the young of the bull-frog; but this is not so; it seems to be a distinct variety of the frog family. He makes himself heard in the spring as soon as the ice is melted, and is most musical during the evening. You will find him sitting among the old brown grasses and leaves at the edge of the water; and as soon as he hears your footfall, down he flattens himself, and you would easily mistake him for a brown leaf, but, trusting to your ears and not eyes, you soon

will see this brown leaf cautiously rise up, swell its little throat to half the size of its body, and give a "peep" shrill enough to leave no doubt as to what makes that sound. These frogs are, when sitting, an inch long, and vary in color from a light to a very dark brown. They are easily caught, and by putting them in a wide-mouthed bottle covered with thin muslin; and placing this under a hat, or in any place away from the light, they will continue their peeping for some time.

The Paper Nautilus.—The shell of the paper nautilus is not chambered like that of the true nautilus, but has one spiral cavity, into which the animal can entirely withdraw itself. The animal has no muscular attachment to the shell, and some naturalists therefore suspected that it might be



THE PAPER NAUTILUS.

merely, like the hermit crab, the inhabitant of a shell originally belonging to some other animal; but this question has been set at rest by the observations of Madame Power, proving the beautiful but fragile shell to be the production of the paper nautilus itself. It has, however, also been discovered that the shell is peculiar to the female, and does not answer the ordinary purposes of the shells of mollusca, but rather that of an "incubating and protective nest." The eggs, which are very numerous, are attached to filamentary stalks, and by these the whole compacted mass is united to the involuted spire of the shell, where it is usually concealed by the body of the parent.

Flying Fish.—This is the name given to all those fishes which have the pectoral fins so very large that by means of them they are sustained in short

seeming flights in the air. They swim in shoals; and whole shoals—varying in number from a dozen to one hundred or more—often leave the water at once, darting in the same direction through the air, and after descending into the water at a distance of two hundred yards or even more, from the place where they arose, quickly renewing their flight. These flights of flying fishes form one of the most interesting and pleasing spectacles which relieve the monotony of a voyage in the tropical seas. Sometimes, the coryphæa (dolphin) may be seen in rapid pursuit, taking great leaps out of the water, and gaining upon his prey, which take shorter and shorter flights, vainly try to escape their persistent foe, until they sink at last exhausted; some-



THE FLYING FISH.

times the larger sea-birds catch flying fishes whilst they are in the air. They occasionally rise to the height of twenty feet above the water, although they more frequently skim along nearer to its surface. They often fall on the decks of ships. They are good food, and the natives of the South Sea Islands take them by means of small nets attached to light poles, like those in which anglers catch minnows for bait. For this purpose, they go out at night in canoes, to the outer edge of the coral reefs, with a torch, which enables them to see the fishes, and perhaps both attracts and dazzles them.

The Sea Horse.—This remarkable fish is found near our South American coasts. It belongs to the singular order known as *Lophobranch*,

or tuft-gilled, which differ from other fishes in the peculiar structure of the gill arches, by which the gills are arranged in little tufts on each side of the head, under the cheek bones or gill covers. The structure of the sea horse's tail is unlike that of any other fish, being covered with an envelope, consisting of long scales, four-sided, prehensile, like that of a monkey, and of considerable length. In the act of excluding its young, it catches its tail around some object, such as a shell, and drawing its pouch downward against the object, pushes up the contents, forcing the young out of the opening at the top of the pouch. The sea horse is a very pretty creature. Its general color is ashen gray; an exceedingly sober suit. But if examined more closely, it will be found thickly studded with tiny spangles of metallic silver; it has pretty golden eyes, which, independent of each other, intently gaze two ways at once. Thus the sea horse, though anomalous in form and habit, has beauty united with its strange features, and grace with its eccentricity.

Brazilian Turtles.—The size of Brazilian turtles may be imagined from the fact that the flippers and feet of one, in crawling over the sand, leave a track of two irregular grooves three or four feet apart, as though a great wagon with cog-wheels had been



THE SEA HORSE.

driven over the ground. It is an easy matter to find a turtle's nest by this track. She comes out of the sea, and travels far up the beach to lay her eggs in the sand, digging a hole two feet deep for the nest. Professor Hart says that he saw a turtle deposit one hundred and forty-three eggs in one of these nests. The eggs are all laid at one sitting, covered with sand, and left to hatch. They are round and rather larger than hens' eggs. The Brazilians eat the eggs, and also the flesh of the turtle. The creature is captured in a curious way. Two persons go behind it, and, taking hold of the shell, turn the animal on its back, in which position it is at the mercy of its captors, as it is impossible for it to turn on its feet again.



THE LYRE-BIRD.

The Lyre-Bird.—Only two species of this singular bird are described, both natives of Australia. The common lyre-bird has been placed among pheasants. Its name indicates its general resemblance to these. The length is about forty-three inches, of which the tail is twenty-five; the bill is rather more than an inch long, resembling that of a peacock, strong, keeled, broad at the base, and of a black color; the nostrils long and narrow, in a fosse near the middle of its length; the wings moderate and rounded; the body about the size of that of a pheasant; tail very long and of a singular form, differing in the two sexes. The general color above is brownish black, and grayish brown below; the head slightly crested, and the throat rufous; there are three kinds of feathers in the tail, which are long, and sixteen in number; twelve have long, slender shafts with delicate filaments, more and more distant toward the end; the middle two feathers, longer than the rest, are pointed at the end and barbed only on the inner edge; the external two feathers are broad, growing wider to the ends, and curving outward, like an elongated S, the two resembling much the outlines of the ancient lyre. They are shy, running rapidly among the brushwood; they live in pairs, in rocky places overgrown with bushes.

The Ostrich.—The ostrich is the largest of all birds now existing, being from six to eight feet in height to the top of its head, and an adult male weighing from two to three hundred pounds. The male is rather larger than the female. The head and upper part of the neck are scantily covered with a thin down, through which the skin is visible. The young have the head and neck clothed with feathers. The general plumage is glossy black in the adult male, dark gray in the female and young, with a slight sprinkling of white feathers; the long plumes of the wings and tail are white, occasionally marked with black. On each wing are two plumeless shafts, not unlike porcupine's quills. The inner toe is very large, about seven inches long, and its claw hoof-like. Whilst the sternum is destitute of a keel, and the muscles which move the wings are comparatively weak, those which move the legs are of prodigious strength, so that the ostrich is not only capable of running with great speed, but of striking such a blow with its foot as to make it too formidable for the leopard and other large beasts of prey to assail it. It has been often known to rip open a dog by a single stroke, and a man is recorded to have suffered the same fate. The eyes of the ostrich are large, and the lids are furnished with lashes. Its sight is keen, so that it descries objects at a great distance in the open desert.

The ostrich shuns the presence of man, but is often to be seen in near proximity to herds of zebras, quaggas, giraffes, antelopes and other quadrupeds. It is gregarious, although the flocks are not generally very large. It is polygamous, one male usually appropriating to himself, when he can, from two to seven females, which seem to make their nest in common, scooping a mere hole in the sand for this purpose. Each female is supposed to lay about ten eggs. The eggs are all placed on end in the nest, which often contains a large number, whilst around it eggs are generally to be found scattered on the sand. By a remarkable instinct, the ostrich sits upon the eggs by night, when the cold would be too great for them, and leaves them to the sun's heat during the day. It feeds exclusively on vegetable substances, its food consisting in great part of grasses and their seeds; so that its visits are much dreaded by the cultivators of the soil in the vicinity of its haunts, a flock of ostriches soon making terrible devasta-

tion of a field of corn. The speed of the ostrich, when it first sets out, is supposed to be not less than sixty miles an hour; but it does not seem to be capable of keeping up this speed for a long time. It is successfully hunted by men on horseback, who take advantage of its habit of running in a curve, instead of a straight line, so that the hunter knows how to proceed in order to meet it and get within shot. It is often killed in South Africa by men who envelop themselves in ostrich skins, and admirably imitating the manners of the bird, approach it near enough for their purpose, without exciting its alarm, and sometimes kill one after another.

The eggs of the ostrich are much esteemed as an article of food by the rude natives of Africa. Each egg weighs about three pounds. They are



THE OSTRICH.

usually dressed by being set upright on a fire and stirred about with a forked stick, inserted through a hole in the upper end. The thick shell is applied to many uses, but particularly for water-vessels. In taking ostrich eggs from the nest the South African is careful not to touch any with the hand, but uses a long stick to draw them out, that the birds may not detect the smell of the intruder, in which case they would forsake the nest.

The great value of the feathers has induced men of late years to engage in the domestication of this bird, and ostrich farming is now a most lucrative employment at the Cape of Good Hope. It is said that a full-grown bird yields one hundred feathers at a picking, which sell at Cape Colony for one hundred and eighty dollars.

The Condor.—The condor is a native of the Andes, and the largest of known flying birds. The wings are long, measuring fourteen feet when spread, and extremely powerful; the tail short, and wedge-shaped; the general color black, which is brightest in old males, the young being of a brownish color, which has given rise to a notion that there are two species; the males are also distinguished by having great part of the wings white. Around the lower part of the neck of both sexes there is a broad white ruff



THE CONDOR.

of downy feathers, above which the skin is bare, and exhibits many folds. The condor feeds mostly on carrion. Its voracity is enormous. Tschudi mentions one in confinement at Valparaiso which ate eighteen pounds of meat in a single day, and seemed next day to have as good an appetite as usual. They inhabit regions 10,000 or 15,000 feet above the level of the sea, where they breed, making no nest, but laying their eggs on the bare rocks, and where they are usually seen in small groups. To these haunts they return,

after their descents into the plains for food. The height to which the condor soars in the air exceeds that of any other bird, and is said to be almost six perpendicular miles above the level of the sea, or nearly six times the ordinary height of the clouds.

The Vulture.—Vultures are mostly found in warm climates, and many of them are inhabitants of mountainous regions. They feed on carrion, which it seems to be their office in nature to remove from the face of the earth, that the evil consequences of its corruption may be prevented.



THE VULTURE.

They seldom attack a living animal, but they have been seen to sit and watch the approach of death, waiting for their feast. They are not in general courageous birds, and often put to flight by birds much smaller than themselves; yet, if unmolested, they readily become familiar with the presence of man, and some of them seek their food even in the streets of towns, in which they are useful as scavengers. They gorge themselves excessively when food is abundant, till their crops form a great projection, and sit long in a sleepy or half-torpid state to digest their food. They do not carry food to their young in their claws, but disgorge it for them from the crop. The

bareness of their head and neck adapts them for feeding on putrid flesh, by which feathers would be defiled; and they are very careful to wash and cleanse their plumage.

The Solitaire.—The solitaire is a wingless bird of the dodo family. The male is brownish gray, a little larger than a turkey, but the beak is more hooked and the neck longer and straighter; the tail very short, and the posterior part of the body rounded; the eyes black and lively, the head



THE SOLITAIRE.

without comb or crest. The female smaller and lighter colored. It received its name from its being generally seen alone. It is a native of the island Rodriguez, a few miles east of Mauritius. It is monogamous, making a nest on the ground of the leaves of the palm, laying one egg, larger than that of a goose; the young require to be fed in the nest. The flesh is said to be fat and good eating, and the food the fruit of the date palm.

The Bittern.—Bitterns are chiefly distinguished from herons by the long, loose plumage of the neck, which they have the power of erecting at

pleasure, with the rest of their clothing feathers, so as greatly to increase their apparent size. The back of the neck, however, is merely downy, or almost bare, the long feathers being on the front and sides. Bitterns also differ from herons in the greater length of their toes, the middle toe being as long as the shank. They are almost all solitary birds, inhabiting reedy and marshy places, where they lie during the day, and will almost allow themselves to be trodden upon ere they take wing; they feed during the night, and then often rise spirally to a great height into the air, and emit loud resounding cries. Their food consists chiefly of frogs, and partly, also, of fish, lizards, water-insects, etc., and even of small birds and quadrupeds.



THE BITTERN.

The claw of the middle toe is serrated on the inner edge, probably to aid in securing slippery prey. The bird is very widely diffused over the world, being found in almost all, at least of the temperate, parts of Europe, Asia, Africa and North America, which are sufficiently marshy for its manner of life. In size it is rather less than the common heron; the bill is about four inches long, the feathers on the crown of the head are greenish black, and the plumage in general of a dull yellow color, beautifully and irregularly marked and mottled with black. It makes a rude nest of sticks, reeds, etc., in its marshy haunts, and lays four or five greenish-brown eggs. It has a peculiar bellowing cry, which has obtained for it such names as *Mire-drum*,

Bull of the Bog, etc. Some naturalists used to assert that the booming cry of the bittern was produced by the bird inserting its bill into a reed; that notion, however, has long since been exploded. When assailed, it fights desperately with bill and claws; and it is dangerous to approach it incautiously when wounded, as it strikes with its long sharp bill, if possible, at the eye.

The Heron.—The bill of the heron is long, compressed, and sharp; the tail short; the legs and the toes long and slender; the wings long; the bill is slender, but strong, forming a compressed and lengthened cone; the plumage is beautiful, but seldom exhibits very gay colors; white, brown, black, and slate color, finely blended, being generally predominant. The body is small in proportion to the length of the neck and limbs; the neck is long, and, except in flight, is usually held curved. In flight, the heron car-



THE HERON.

ries the neck, head, and long bill in a straight line before the body, and the long legs in like manner stretched out behind. Herons feed mostly on fish, frogs, and other aquatic animals; and may be seen, particularly very early in the morning and late in the evening, standing patiently motionless in some shallow water, at the margin of a lake or stream, or on the sea-shore, waiting till prey come within reach. In default of their more common food, however, herons sometimes prey on young birds, reptiles, and the smaller mammalia. They usually go forth singly in quest of prey, but are mostly gregarious.

The Cuckoo.—The name cuckoo is derived from the note of the male, which, although monotonous, is always heard with pleasure. It frequents both cultivated districts and moors. There is no pairing or continued at-

tachment of the male and female, and the female, after having laid an egg on the ground, deposits it, *with her beak*, in the nest of some other smaller bird, leaving the egg to be hatched and the young one to be fed by the proper owners of the nest. The egg of the cuckoo is very small for so large a bird, being not larger than the skylark's, and the number she will lay is uncertain; but the young one soon acquires size and strength enough to eject from the nest any eggs which may remain in it, or unfortunate young birds, the true offspring of its foster-parents, and it seems restless and uneasy till this is accomplished. It works itself under them, and then jerks them out by a motion of its rump. Its back at this early age exhibits a peculiar depression between the shoulders, so that an egg or a young bird can easily be got to lie upon it; but this depression soon disappears, and with it

the singular instinct with which it is supposed to be connected.



THE ROSEATE SPOONBILL.

The Roseate Spoon-

bill.—Spoonbill is the common name of the wading birds, characterized by a much depressed bill, very broad and dilated at the end in the shape of a rounded spoon. Wings long, second quill the longest; tail short; legs long; toes webbed at the base. There are about a half dozen species, found in all quarters of the globe, migrating to warm climates at the approach of winter. They frequent marshy inlets of the sea and the borders of lakes and rivers, wading about in search of fish, worms, frogs; they can swim and even dive. The roseate spoonbill is about thirty inches long, the bill being seven inches, and covered with a soft skin; the head is of moderate size, bare, the

skin yellowish green, the neck long and slender, and body compact. The color is rosy red, paler in front, and white on the neck; and lower part of the throat bright carmine; tail feathers, ochrey yellow; the young have the head feathered, the carmine tint wanting and the tail rosy. It is found in the southern Atlantic and Gulf States, and is abundant in the Indian river, Florida. They are essentially nocturnal, though they often feed by day when the tide suits; they fly with the neck and legs extended, and rise rapidly to a great height. They alight easily on trees, and can walk on the large branches; the nest is usually in the top of a mangrove, coarsely made; the eggs are three, white, sprinkled all over with bright spots. They breed and are seen in flocks; the beautiful feathers of the wings are made into fans.

The Eagle.—From the most ancient times, the eagle has been universally regarded as the emblem of might and courage; and, like the lion, it has been fancifully invested with other attributes of greatness, such as men thought to harmonize with these. Its extraordinary power of vision, the vast height to which it soars in the sky, the wild grandeur of the scenery amidst which it chiefly loves to make its abode, and perhaps also its longevity, have concurred to recommend it to poetic regard. The golden eagle is the largest of the European species, and is found not only throughout Europe, preferring wild and mountainous situations, but throughout almost the whole northern hemisphere; it is among the birds of India, of the north of Africa, and of North America; and the savage warrior of the Rocky Mountains, as well as the Highland chieftain, glories in his eagle plume. It builds its nest only in mountainous districts, carrying a few sticks and brambles to the inaccessible shelf of a rocky precipice, where the eggs are deposited almost on the bare rock.



THE STORK.

The Stork.—The stork is about three feet and a half in length. The head, neck, and whole body are pure white—the wings partly black—and the bill and legs red. The neck is long and generally carried in an arched form; the feathers of the breast are long and pendulous, and the bird often has its bill half hidden among them. It frequents marshy places, feeding on eels and other fishes, batrachians, reptiles, young birds and small mammals. It makes a rude nest of sticks, reeds, etc., on the tops of tall trees, or of ruins, spires or houses. In many parts of Europe, especially in Holland, it is a very common practice to place boxes for storks, and it is considered a fortunate thing for a household that the box on the roof is occupied. Storks are protected by law in some countries, on account of their good services not only in destroying reptiles and other troublesome animals, but in the removal of offal from the streets of towns, in which they stalk about with perfect confidence, even in the midst of throngs of people. They have been celebrated from ancient times for the

affection which they display towards their young; and have also had the reputation—not so well founded—of showing great regard to their aged parents. Before they take their departure from their summer haunts, they congregate in large flocks, which make a great noise by the clattering of their mandibles, and are popularly regarded as holding consultation. The stork has no voice. Its flight is powerful and very high in the air.

The Crane.—The family to which this bird belongs differs from herons, bitterns, storks, etc., in having the hind-toe placed higher on the leg than



THE CRANE.

the front ones. It consists also of birds less addicted to marshy places, and which feed not only on animal, but, to a considerable extent, on vegetable food. They are all large birds, long legged, long necked and of powerful wing, although their wings are rounded and not elongated; some of them performing great migrations, and flying at a prodigious height in the air. The crane breeds in the northern parts of Europe, Asia, and North America, retiring in winter to tropical or sub-tropical regions. When standing, it is about four feet in height; the prevailing color is ash-

gray, the face and throat nearly black, the wing primaries black. The tertial feathers of the wings are elongated, reaching beyond the ends of the primaries, and their webs are unconnected; they are varied and tipped with bluish-black, and are the well-known plumes once much used in ornamental head dresses. It feeds on roots, seeds, etc., as well as on worms, insects, reptiles, and even some of the smallest quadrupeds.

The Crested Grebe.—Grebe is the generally accepted name for all the birds of the family *Podicipedidae*, belonging to the group *Pygopodes* of Illiger, members of which inhabit almost all parts of the world. Grebes are at once distinguishable from all other water-birds by their very short body and the peculiar structure of their feet, which are not only placed far behind,

but have the tarsi flattened and elongated toes furnished with broad lobes of skin. In Europe there are five well-marked species; North America is credited with seven, while South America possesses five. The crested grebe, known in some parts of England as the loon, is widely spread over both worlds, and though apparently not found within the tropics, is known in the extreme south as a native of Australia and New Zealand. Grebes in general, though averse to taking wing, have much greater powers of flight than would seem possible on examination of their alar organs, and are ca-



THE CRESTED GREBE.

pable of prolonged ærial journeys. The plumage is short and close. Above, it is commonly of some shade of brown, but beneath it is invariably white, and so glossy as to be in much request for muffs and the trimming of ladies' dresses. Some species are remarkable for the crests or tippets, generally of a golden chestnut color, they assume in the breeding season. *P. auritus*, the subject of our engraving, is particularly remarkable in this respect, and when in the full nuptial attire presents an extraordinary aspect, the head (being surmounted, as it were, by a nimbus or aureole, such as that with which painters adorn saintly characters), reflecting the rays of light, glitter with a glory that passes description. Young grebes are beautiful objects, clothed with black, white and brown hair disposed in streaks, and their bill

often brilliantly tinted with yellow. On land they are awkward creatures, but in water they equal, if indeed they do not surpass, their parents, in the power of diving, which is a special accomplishment of all grebes.

The Cormorant.—This is a genus of web-footed birds of the family *Pelecanidæ* having, like the rest of that family, the hind-toe united in a single membrane with the other toes. The species are distributed over the coasts of most parts of the world; some of them occasionally ascending rivers in pursuit of fish, on which all of them exclusively live, and even visiting inland lakes. They are proverbial for their excessive voracity. They do not take their prey by diving when on wing, but pursue it by swimming and diving, using their wings in progress under water, and descend to a wonderful



THE CORMORANT.

depth; the smaller of the two British species has been caught in a crab-pot fastened one hundred and twenty feet under water. When the prey has been caught in a manner inconvenient for swallowing, they toss it in the air, and adroitly catch it as it descends. Some of the species frequent high rocks, others low islands, on which they make rude nests, chiefly of seaweed; some perch and even build their nests on mangroves and other trees. Their eggs are covered with a calcareous incrustation. The flesh of all the species is dark, and of a fishy taste, but is sometimes used as food, particularly that of young birds. The commonest species are the common cormorant, which is mostly of a black color, but for a short time during the breeding season exhibits a sprinkling of longish white, almost bristly feathers on the head and back of the neck; and the green cormorant, which is of smaller size and of a prevailing dark green color. The common cormorant is about thirty-three inches long. It is a very widely distributed species. It was

formerly sometimes tamed in England, to be employed in catching fish, and is still trained to this use in China.

The Bird of Paradise.—This is the common name of a family of birds, *Paradiseidae* of ornithologists, found chiefly in New Guinea and neighboring islands, and remarkable for splendor of plumage. In all other respects, however, they are very closely allied to the crow family. The males alone are birds of splendid plumage, that of the females possessing neither



THE BIRD OF PARADISE.

brilliancy of colors nor remarkable development. The plumage of the males is not only characterized by great brightness of tints, but by a glossy, velvety appearance, a metallic lustre, and a singularly beautiful play of colors. Tufts of feathers generally grow from the shoulders, and these, in some of the kinds, are prolonged so as to cover the wings; in the species sometimes called the common Bird of Paradise, and sometimes the Great Emerald Bird of Paradise, the prolongation of these shoulder tufts is so great, that they extend far beyond the body, and even far beyond the tail. They constitute the most magnificent part of the well-known Bird of Para-

dise plumes. They are exquisitely light and delicate. These birds are, in general, more or less gregarious. They sometimes pass in flocks from one island to another, according to the change of seasons, from the dry to the wet monsoon. Owing to their plumage, they fly more easily against than with the wind, and by high winds they are sometimes thrown to the ground. Their food consists in great part of the fruit of the teak tree, and of different species of fig, and also of the large butterflies which abound in their native islands. The Papuans kill them by shooting them with arrows, and employ various other means of taking them for the sake of their skins. The common Bird of Paradise is as large as a jay. It is of a cinnamon color, the upper part of the head and neck yellow, the front and throat emerald green,

the shoulder-tufts yellow. The whole length of the extremity of these is not less than two feet.



THE FALCON.

The Falcon.—This famous bird of prey is characterized by a bill curved from the base, the upper mandible hooked at the point, and the cutting edge of the upper mandible furnished with a strong projecting notch, or *tooth*. The claws are also sharp, curved, and strong; and in accordance with all this powerful armature, the whole frame is very robust and muscular. The legs are rather short, and have great power in striking or seizing prey. The keel of the sternum (breastbone) is very large, and adapted for the attachment of powerful muscles; the furcula and cora-

coid bones are also very strong, so as to afford a sufficient resisting base for very powerful action of the wings. The wings are long and pointed, the first and third quill-feathers of equal length, the second rather the longest, the first and second emarginated near the tip. The true falcons are bolder in proportion to their size than any other *Falconidæ*—even eagles. Their acuteness of vision is wonderful, and they have very great powers of flight. A falcon is known to have traversed the distance between Fontainebleau and Malta, not less than 1,350 miles, in twenty-four hours. The speed obtained by a falcon in pursuit of its prey has been calculated to be at the rate of 150 miles an hour. They soar to a prodigious height in the air, always endeavoring to outsoar any bird of which they may be in pursuit, and to swoop down upon it from above; although it is far more difficult for them to rise vertically in a calm atmosphere than for birds of short and rounded wing, and they either rise obliquely—often also making their onward flight in a series of arcs—or avail themselves of the wind, and by flying against it, are borne aloft as a boy's kite is. The species are numerous; some of them are of very wide distribution, while others are peculiar to certain countries.

The Tailor-Bird.—This is a genus of birds of the family *Sylviadæ*, with a long, graduated tail, the feathers of which are narrow. The species are numerous, natives of the East-Indies and of the Indian Archipelago, and haunt cultivated grounds, where they are commonly seen in pairs. Their flight is rapid and undulating, and they seldom ascend above the lower branches of trees. The name *tailor-bird* is derived from the way in which the nest is formed. Two leaves are taken at the extremity of a twig, and are sewed together by their edges, or a large leaf is sewed together; the



THE TAILOR-BIRD.

necessary holes being made by the bill, and vegetable fibers forming the thread. Within the hollow thus made, a quantity of a cottony substance is placed to receive the eggs.

The Thrush.—The song thrush, or throistle, the mavis of the Scotch, is smaller than the black-bird, its whole length being not quite nine inches. Its plumage is brown, of various finely-mingled shades; the throat, sides of the neck, breast, and flanks yellowish, spotted with dark brown; the belly nearly white, with a few spots of dark brown; a dark brown streak, with a lighter brown streak over it, passing from the bill to the eye. It is found in all parts of Europe, but deserts some of the northern parts in winter, being thus partially a bird of passage. It feeds on insects, worms, slugs, snails,

berries, and seeds. It often makes its nest in the center of a thick bush or shrub, and sometimes in an open shed. The eggs are usually four or five in number. The male takes part in the work of incubation, and is very attentive in feeding his mate while so occupied. The thristle is well known as one of the sweetest songsters of the groves. In captivity, it has been taught simple airs.

The Wheatear.—The wheatear or fallow-chat is a bird of the genus popularly known by the name chat, of the family *Sylviadæ*, a common sum-



THE WHEATEAR.

mer visitant of Great Britain, abounding on downs and fallow fields. Its geographic range is wide. Its winter retreat is in the countries near the Mediterranean, and chiefly in Africa; its summer migrations extend to the farthest north of Europe, and to Iceland and Greenland. The entire length of the wheatear is about six inches and a half; the tail is almost square; the wings are long and pointed; and the legs are long, enabling the bird to hop about actively in quest of food. Its food consists of worms and insects, and it may often be seen perched on the top of a clod or stone, looking out for them, and at the same time on the watch against enemies. The male is of an ash-brown color on the upper parts; the forehead, a band above the eyes, and the throat, white; a black mark extending from the base of the bill to

each eye, and expanding behind it, so as to cover the orifice of the ear; the wings, black; the rump, and two-thirds of the tail, except the two middle feathers, white; the tip of the tail, black; the two middle feathers of the tail, entirely black; the breast, buff-color; the belly and flanks, pale buffy white. The female is less gaily colored, brown and gray prevailing. The wheat-ear makes its nest in an old wall, or in a crevice of a quarry or gravel-pit, often in a deserted rabbit-burrow, and generally lays six pale-blue eggs.

The American Bluejay.

—This beautiful bird is common to nearly all sections of the United States, from the Gulf of Mexico to Canada. It is an inhabitant of forests and wooded districts, and feeds principally upon seeds and fruits. The head is furnished with a crest of erectile feathers; the tail is long and rounded. The general color of the upper parts is bright purplish-blue; the wings and tail white, barred with black; the neck surrounded with a curved black collar. They build in thick trees or bushes, and their nest is a basket-like structure of small sticks, lined with fine roots and grasses; the eggs, five or six in number, are yellowish-white, minutely and thickly speckled with light brown. The character of the bird is omnivorous, and it often robs the nests of other birds.



THE AMERICAN BLUEJAY.



THE SKYLARK.

The Skylark.—The skylark is one of the best known British birds, and notwithstanding the tameness of its brown plumage, is a universal favorite, on account of the sweetness of its cheerful song, which it pours forth while soaring and floating in the air. It more rarely sings on

the ground. It is in great repute as a cage-bird, and sings well in confinement, but flutters its wings while singing, as if still desirous of soaring in the air. It abounds chiefly in open but cultivated districts. It is common in most parts of Europe, but from the more northern parts it migrates southward on the approach of winter. It is also a native of Asia.

The Belted Kingfisher.—Many species of the kingfisher family are found in various parts of the world.



THE BELTED KINGFISHER.

plender twigs, roots and dry grass, in hollow trees, in holes of cliffs, under eaves of houses, or, readily enough, in boxes, which are often placed for them in trees or elsewhere near houses. They frequently breed twice in a season, and in autumn they unite in large flocks. The starling becomes very familiar in confinement, and displays great imitative powers. Its song is soft and sweet. The American starling or meadow lark is larger than the common starling. It is common in the United States, migrating northwards in spring, and southwards in autumn, and congregating in great flocks in autumn and winter.

The belted kingfisher is peculiar to North America, and is a larger bird than the kingfisher of Great Britain, being fully twelve inches in length, but inferior in brilliancy of plumage. It is common upon most of our rivers during the warm season, but migrates southward in winter, and is then to be found in the West Indies. Its food consists of small fishes, such as minnows, sticklebacks, and trout or salmon fry, and of leeches and water insects. When it has caught a fish, it often kills it by beating it on a branch, and always swallows it head foremost.

The Starling.—The common starling of the old world is a beautiful bird, rather smaller than the song-thrush or mavis, brown, finely glossed with black, with a pale tip to each feather, giving the bird a fine speckled appearance, particularly on the breast and shoulders. Starlings make artless nests of



THE STARLING.

The Bobolink.—This beautiful bird generally makes its nest in a grassy meadow, an artless structure of a few dry stalks and leaves, with a lining of finer grass. It displays the same instinct with many other birds, of seeking to lead intruders away from its nest, by pretending great anxiety about some other part of the field. During the breeding season, the males are very musical, singing mostly in the air, in which they seem to rise and fall in successive jerks. Their song is very pleasing, and is emitted with a volubility bordering on the burlesque. On account of their beauty and powers of song, many are caught, caged, and sold in New York and other markets.

The Titlark.—This bird is familiarly known in many parts of England and of Scotland as the *Moss-cheeper*. It is found in almost all parts of Europe, and the north of Asia, in Western India, in Japan, and in Iceland. It is a small bird, its color brown of various shades. It frequents heaths, mosses, and pastures; and usually makes its nest on a grassy bank, or



THE TITLARK.

beside a tuft of grass or heath. Its song is weak and plaintive, and it generally sings in the air. It is gregarious in winter. The cuckoo is said to deposit its egg more frequently in the nest of the titlark than in that of any other British bird. A rather larger British species is the tree pipit or field titling, which has a shorter claw, and perches on trees, frequenting enclosed and wooded districts. It is a summer visitant of Britain, and most common in the south of England. It occurs in most parts of Europe, in Asia and the north of Africa.

Butterflies.—If, having never seen nor heard of a butterfly, one were to meet our gaze as on winnowing wings it danced through the summer air, from flower to flower, should we conceive it possible that it had ever been a crawling and voracious worm, and then a torpid being enveloped like a mummy in a case, whence it sprung forth in newness of life, light winged, and graceful in every movement, and arrayed with beauty? Although we know this to be the fact, when we look at the sluggish, leaf-eating cater-

pillar, and contrast it with what it will be, when on broad wings it traverses garden and meadow, extracting from the flowers their nectar for food, we feel involuntary emotions of wonder, so striking is the contrast.

On its exclusion from the egg the caterpillar is of very small size; its growth, however, soon commences, and is as rapid as its appetite is voracious. As, however, it is clothed in an outer skin which is not extensible, this investment, like the armor of the lobster, must be repeatedly changed. Beneath the old outer skin, or epidermis, which soon begins to be loosened,



BUTTERFLIES.

a new one is formed; a rent takes the place from the swelling out of the animal, down the back of the old skin, and this rent gradually increases, till the animal with a brighter epidermis, frees itself from its discarded weeds and appears of larger dimensions. During this process, which is often repeated, the caterpillar is sluggish and inactive, and refuses food; but when the process is over, it recovers its former voracity. During all this time the caterpillar is laying up an accumulation of fat to serve the wants of the system during the time of its torpid pupa state, which it is now preparing for. Beneath the last cuticle assumed, the vital energies of the

system have developed wings, *antennæ*, a slender proboscis, and all the parts of the perfect butterfly, or moth, that is to be. This last cuticle or epidermis is, however, yet to be cast off, and another is formed to clothe the pupa, which in its turn is to be broken open for the exit of the perfect insect. Previously, however, to the pupa stage being assumed, it secures itself by means of its silk in a position varying according to the species. Suppose it merely suspends itself by the tail; in this case the first care of the caterpillar is to cover the spot to which it is about to suspend itself with successive layers of silken threads, which readily adhere, till at last a little silken cone is produced, into which the caterpillar pushes its hinder pair of prolegs (those on the last segment), which become entangled, and so fixed, amid the threads; it then permits itself to hang down with the head lowest. In a short time it begins to bend its back, bringing the head near the attached feet; and, after continuing for some time in this attitude, it straightens itself, and repeats the same action. In about twenty-four hours the outer skin begins to split down the back, and the fissure is enlarged by the swelling of the chrysalis till at length the head and lower portion of the suspended being become disengaged, the skin shrivelling up into a bundle surrounding the tail. This, however, has to be thrown off, and at the same time the chrysalis has to avoid disengaging itself from its mooring of silken threads from which it hangs; for, be it remembered, it was by its hind legs that it attached itself.

To effect this, instinct guided, it seizes on a portion of this shrivelled skin between two segments of its body, holding it as with a pair of pincers, and thus destitute of limbs, supports itself, till it withdraws the tail from the old useless skin which sheathed it; then, still clinging, elongates the rings of its tail as much as possible, and seizes a higher portion of the skin, and in this manner, climbing backward as it were upon its *exuviae*, it repeats the manœuvre till the extremity of the tail presses the silk, to which it immediately adheres by means of a number of hooks provided for the purpose. Still these *exuviae* encumber it and hang in contact with it; curving its tail in such a manner as partly to embrace the shrivelled skin, it whirls rapidly round, jerking violently, and at length succeeds in disengaging it from its fastenings and throwing it to the ground. In a short time the chrysalis hardens, and shows through the outer case the wings, *antennæ*, eyes, and legs of the perfect insect. It now passes into a sort of torpid state, till the time arrives for the exit of the perfect butterfly from its case. The butterfly, when ready for exclusion, bursts the skin of the chrysalis, now to be thrown off, which cover the thorax, and emerges, feeble and languid, with wings crumpled up into small bundles. Soon, however, the body acquires strength; the fluids circulate through the nerves of the wings; these gradually unfold, and the creature quivers them, as it feels its growing powers; at length, in the perfection of strength and beauty, it leaves its sordid mummy-case behind, soars aloft, seeks the flowers of the garden, and commences a new existence.

The rest of the story is soon told; bright things must fade; the butterfly enjoys a brief summer, deposits its eggs on the plants which instinct teaches it are the appropriate nourishment of the future caterpillar, and passes out of existence.

The Humble Bee.—The domicile of the humble bee is a simple excavation in some bank, a little chamber of about six or eight inches in diameter, to which leads a long winding passage, capable of admitting of

the ingress and egress respectively of two bees at the same time. Some species, as the *bombus muscorum*, select a shallow excavation which they dome over with a felt of moss or withered grass, lined with a coat of wax to render it waterproof; but the *bombus terrestris* makes or enlarges a subterranean vault, a foot beneath the surface of the ground, and in this is the colony established. The population, however, is not numerous, seldom exceeding one or two hundred, and may be divided into *females*, *males* and *workers*. The females are of two sorts, *very large* and *small*. The large females, or queens, look like giants compared to the smaller females and workers; they produce males, females and workers, but the small females produce only small eggs. The large females, then, we may regard as the founders of every colony; and by following up the details we shall be able to render the plan clearly intelligible. These large females, in an established colony, emerge from their pupa state in the autumn, and pair in that



NEST OF THE COMMON HUMBLE BEE.

season with males, the produce of the small females which have previously acquired their due development. Now on the approach of winter these large females, the pairing time over, retire each to a little snug apartment, lined with moss or grass, and separate from the general vault, passing the cold season in a state of torpidity. Early in the spring they awake, issue forth, and take different directions, seeking for some convenient spot in which to begin their labors. At this time of the year large females may be often observed exploring every cavity, hole or crevice in banks or on the ground; they are seeking a fit site for their operations. We will now suppose one of these queens to have formed and established herself in her chamber; she begins to collect honey and pollen, and constructs cells in which her eggs are to be deposited. So rapidly are the latter built, that to make a cell, fill it with honey and pollen (the food of the young), commit one or two eggs to it, and cover them in, requires little more than half an hour. Her first and most numerous brood consists only of workers, which,

as soon as excluded from the pupa, assist their parent in all her labors. Her next consists of large and small females and males; these appear in August or September; but, if Huber be correct, the male eggs, or some of them at least, are laid in the spring with those that have to produce workers. We have now, then, small and large females, males and workers, the produce of the original queen who singly began to found this establishment. It will be interesting to look a little closer into their transactions; and, first, those of the workers. These are by far the most numerous tenants of the colony, and to them is intrusted the reparation of any part by the deposition of wax, and the spreading of it in patches over the roof. When in any of the cells one of the larvæ has spun its cocoon and assumed the pupa state, it is their department to remove all the wax away from it; and after the pupa has attained its perfect state, which takes place in about five days, to cut open the cocoon, in order that the perfect insect may emerge from its imprisonment; it is theirs, moreover, to supply the young grubs with food after they have consumed the stock deposited with each egg in the cell, and regularly feed them either with honey or pollen introduced in their proboscis through a small hole in the cover of each cell, opened as occasion may require, and carefully covered up again. As the grubs increase in size the cells which contained them respectively become too small, and by their struggles the thin slides split; the breaches thus produced they repair with wax as fast as they occur, attentive to see where their services are required; and it is in this manner that the cells gradually acquire an increase of size to accommodate the increasing larvæ. Besides these duties, in chilly weather and at night the workers brood over the pupa shrouded in their cocoons, in order to impart the necessary warmth and maintain a due degree of temperature. They relieve the mother queen, in fact of half her cares and nearly all her labor. In some nests there are from forty to sixty honey pots, the cocoons of the bees recently emerged from their pupa condition, and more than half of these are often filled in a single day.

The workers have plenty of business on their hands and are busy all summer long. But the winter comes and they all perish; they have fulfilled their allotted part, and their services are no more needed. From the workers let us pass to the mother queen, and inquire into her duties and actions. The workers are her first progeny, and we must suppose her surrounded by them. They are watching all her movements, for she is about to deposit in the cells the eggs from which the second brood is to spring; and, by a strange instinct, they endeavor to seize the eggs as soon as laid, and devour them. It is not easy to understand the object to be accomplished by this procedure on the part of the workers, unless it be to keep the population within due bounds. Be this as it may the female has to exert herself to the utmost to prevent her eggs from being all devoured. When she has deposited her eggs in the cells and closed them up with wax, she has still to keep very close watch over them for six or eight hours, otherwise the workers would immediately open the cells and devour their contents. After this period, strange to say, the nature of the workers seems changed; they no longer evince any appetite for devouring the eggs or destroying the cells. From these eggs proceed a few large females, to be at a future day the founders of colonies; a few males, and small females, closely resembling the workers, but attended by the females which form their court. These small females now begin to prepare cells for their eggs, which rouses the anger and jealousy of the mother queen to the highest pitch. She assaults them with fury, driving them away; puts her head into the cells, and devours

their eggs, and is in turn herself assaulted and forced to retreat. They then contend among themselves for various cells, several females often endeavoring to lay their eggs at the same time in the same cell, but after a short period tranquility seems restored. These small females all perish on the commencement of winter. Their produce consists only of males, which pair with the large females in the autumn, the latter retiring to their hybernaculum and sleeping till spring. The males are rather larger than the small females whence they spring, and their antennæ are longer and more slender. They are not an idle race, for Beaumur asserts that they work in concert with the rest to repair any damage that may befall their common habitation. They act in some sort as scavengers of the settlement, removing every sort of rubbish, and the dead bodies of such individuals as may chance to die, but do not forage for building materials and provisions, nor do they take any share in rearing and attending to the young. Such, then, is an outline of the proceedings which occur in every colony of humble bees, all of which, with the exception of a few large females destined to continue the race, perish at the close of autumn.

Spiders.—There are several species of spiders, divided into two classes, the sedentary and the wandering spiders. To the first class belong the orb-weavers, who make a circular web; the line weavers, whose web is labyrinthian; the tube weavers, who hang their nests on walls or rocks or branches of trees; and the tunnel-weavers, who live in tunnels cut into the earth, and having automatic doors ingeniously contrived.

Spiders are not sociable creatures; they are generally, on the contrary, of solitary habits, and are mostly cannibals, eating each other with great gusto. They mate in the spring and autumn, and the mating is often a very trying and dangerous time. They reverse the order of nature in one respect, for the males are infinitely inferior in every respect to the females, and the latter are well aware of the fact. Their courtships are scenes of violence, and not of love and peace. The lady looks with sublime contempt upon the gentleman, and keeps him at a distance. He can only approach her by stratagem, and sometimes she nips off one of his legs in her anger, and casts him adrift a cripple. A spider will never eat her own young, but the males will destroy them when they can. The mother either goes away or dies soon after the hatching of her eggs, which number about one hundred to each nest, and the little ones are thrown upon the world almost as soon as they see light. There are several varieties, however, who carry their eggs in a silk pouch until they are hatched.

Spiders have numerous enemies, and much of their clever nest-building is designed for protection against these inroads. Toads and birds destroy them by the thousand, and a little parasite called the *ichneumon*—a small fly—lays its eggs in the cocoons of the spider, and when the larvæ appears it feeds first on the spider's eggs, and later on the young spiders. Orb-weavers and line-weavers desert their eggs when laid, and meet their offspring, where they live so long, as strangers. Another bitter enemy of the spider is the mud-daubing wasp, who has a process that might be valuable to humanity, if it could be discovered, of keeping a supply of fresh meat. When they capture a spider that is not needed for present use, they sting it in such a manner that it lives, but has no power to move until such time as the captor is ready to devour it.

If you anchor a pole in a body of water, leaving the pole above the surface, and put a spider upon it, he will exhibit marvelous intelligence by his

plans to escape. At first he will spin a web several inches long, and hang to one end while he allows the other to float off in the wind, in the hope that it will strike some object. Of course this plan proves a failure, but the spider is not discouraged. He waits until the wind changes, and then sends another silken bridge floating off in another direction. Another failure is followed by several other similar attempts, until all the points of the compass have been tried. But neither the resources nor reasoning powers of the spider are exhausted. He climbs to the top of the pole and energetically goes to work to construct a silken balloon. He has no hot air with which to inflate it, but he has the power of making it buoyant. When he gets his balloon finished he does not go off upon the mere supposition that it will carry him, as men often do, but he fastens it to a guyrope, the other end of which he attaches to the island pole, upon which he is a prisoner. He then



A SPIDER'S WEB.

gets into his aerial vehicle, while it is made fast, and tests it to see whether its dimensions are capable of bearing him away. He often finds that he has made it too small, in which case he hauls it down, takes it all apart and constructs it on a larger and better plan. A spider has been seen to make three different balloons before he became satisfied with his experiment. Then he will get in, snap the guyrope and sail away, to land as gracefully and as supremely independent of his surroundings as could be well imagined.

The Wasp.—Wasps differ very widely in their habits, some being solitary, others social. Some of the solitary wasps make curious burrows in sand, or construct tubes of earthy paste on the sides of walls, in which they form cells for their eggs, at the same time placing there a store of food for

the larvæ, some of them using for this purpose perfect insects. Others make little earthen cells on the stems of plants, and store in them a little honey for their young. The social wasps have various modes of constructing their nests, which are sometimes formed in excavations in the ground, sometimes attached to walls, boughs of trees, etc., and formed of a paper-like substance, produced by mixing into a pulp, with their saliva, small particles of woody fibre. The combs are made of a substance similar to the outer covering of the nest, but generally thicker and firmer. As the nest is enlarged, new paper is made for the purpose, the whole nest being enclosed in the last-made envelope, and the inner ones, which sufficed for its former size, are removed to give place to combs.

The Water Spider.—The *Arggroneta aquatic* is a plain, dark-brown spider, densely hairy. It dives from a leaf on the surface, and, as it plunges



THE WATER SPIDER.

in, a bubble of air surrounds it attached to its hairy body. Arrived at a desirable location in the midst of a matted mass of water plants, it sets the bubble free by means of its feet in such a manner that it shall lodge amid the vegetation. It repeats the journey until finally the bubble thus produced is large enough; it then spins around its upper part a net to retain it, and anchors this net to the neighboring water plants. If this thimble-shaped diving-bell does not contain enough air, more is now brought down, until finally the satisfied creature establishes itself within its aquatic domicile to look out for passing prey. The silvery guard of the spiders as they descend, and the beauty of their delicate abode, must be seen to be realized, and they form delightful additions to the fresh water aquarium.

White Ants.—These insects live in societies, each of which consists of a countless number of individuals, the large majority of which are wingless. Two individuals only in each society, a male and a female, or, according to some, a king and a queen, are winged, and these alone in the entire society are specimens of the perfect insect. The king and queen are privileged individuals, surrounded with all the respect and consideration, and receiving all the attendance and honors, due to sovereigns. Exempted from all participation in the common industry of the society, they are wholly devoted to increase and multiplication. They are distinguished from the inferior members of the society by the possession of organs of vision in the form of large and prominent eyes, their subjects being all of them blind.

These latter are divided into two classes, the workers and the soldiers. The workers are by far the most numerous members of the society, being about a hundred times greater in number than the soldiers. Their bodies also are smaller than those of the soldiers, the latter being again smaller than those of the sovereigns. The entire industrial business of the society is performed by the workers. They erect the common habitation and keep it in repair. They forage and collect provisions for the society. They attend upon the sovereigns, and carry away the eggs of the queen, as fast as she deposits them, to chambers which they previously prepare for them. They keep these chambers in order, and when the eggs are hatched they perform the part of nurses to the young, feeding them and waiting upon them until they have attained sufficient growth to wait upon themselves. The soldiers are distinguished by their long and large heads, armed with long pointed mandibles. Their duty, as their title implies, is confined to the defence of the society and of their common habitation when attacked by enemies.

A visitor to the tropics unacquainted with the architectural skill of these small builders must pause in wonderment before the habitations which they erect. The insect itself is scarcely a quarter of an inch in length, and yet in the space of three or four years they manage to build a home for themselves that is twelve feet in height. These wonderful structures are shaped like a sugar-loaf or cone, and when first erected consist of naked clay, but, in the fertile climate where the white ant lives, the seeds of herbage transported by the wind are soon deposited upon them, and they are speedily covered with the same vegetation as the surrounding soil, and when in the dry and warm season this vegetation is scorched they assume the appearance of vast hay-cocks. The interior of these mounds themselves are of most curious and complicated structure, consisting of a variety of chambers and corridors formed with the most consummate art, and adapted in shape and size to the respective purposes to which they are assigned in the general economy of the colony.

The royal chamber appropriated to the sovereigns engrosses much of the attention and skill of their industrious subjects. It is generally placed about the center of the base of the mound, at the level of the surrounding ground. It has the shape that architects call a surmounted dome, and its magnitude is proportioned to that of the king and queen to whom it is appropriated. Its floor is perfectly level, and formed of clay about an inch thick. The roof is a solid, well-turned arch, increasing in thickness from a quarter of an inch at the sides, where it rests upon the floor.

TRAVELS, MANNERS AND CUSTOMS, ETC.

China and the Chinese.—Among the higher classes in China the married lady rises early, and first sees that tea is prepared for her husband, as well as some hot water for his morning bath. The same attention is also exacted by the mother-in-law; indeed, during the life of the latter, the wife has



CHINESE LADIES.

to be a very drudge in the house. In the morning the ladies fly about dressed *en deshabille*, and shout out their orders to the domestic slaves. In short, a general uproar prevails in many Chinese households, until everything for the elaborate toilet has been procured. Each lady has generally one or two maids, besides a slave girl who waits on these maids, and trims her mistress's pipe. The dressing of the lady's hair occupies her attendants from one to two hours. Then a white paste is applied to her face and neck, a rose powder to the cheeks and eyelids, and a red dye to the finger nails; and finally the lady is dressed for the day. Many Chinese ladies spend a great portion of their time in gossiping, smoking, and gambling. The last named, it is to be regretted, is the most favorite pastime, but it is the men who set them the example. They never dream of playing except for money; and when they have no visitors of their own rank to gamble with they call in the domestics and play with them. Numbers of ladies pass a portion of their time

in embroidering shoes, purses, handkerchiefs, and such things; while before marriage nearly all their days are occupied in preparations for the dreary event of wedding one whom they have never seen and for whom they do not care. Some women occasionally hire educated widows in needy circum-



A CHINESE BRIDE.

stances to read novels or plays to them. Women capable of reading in this way can make a comfortable living, as there are so very few of the female sex who can read. The women of the poorer classes have no education, and can be considered but little better than beasts of burden. A man of that rank will walk deliberately by his wife's side, while she totters under a heavy load; and frequently may she be seen yoked to a plow, while her husband guides it. Those of the lower classes who are good looking, ac-

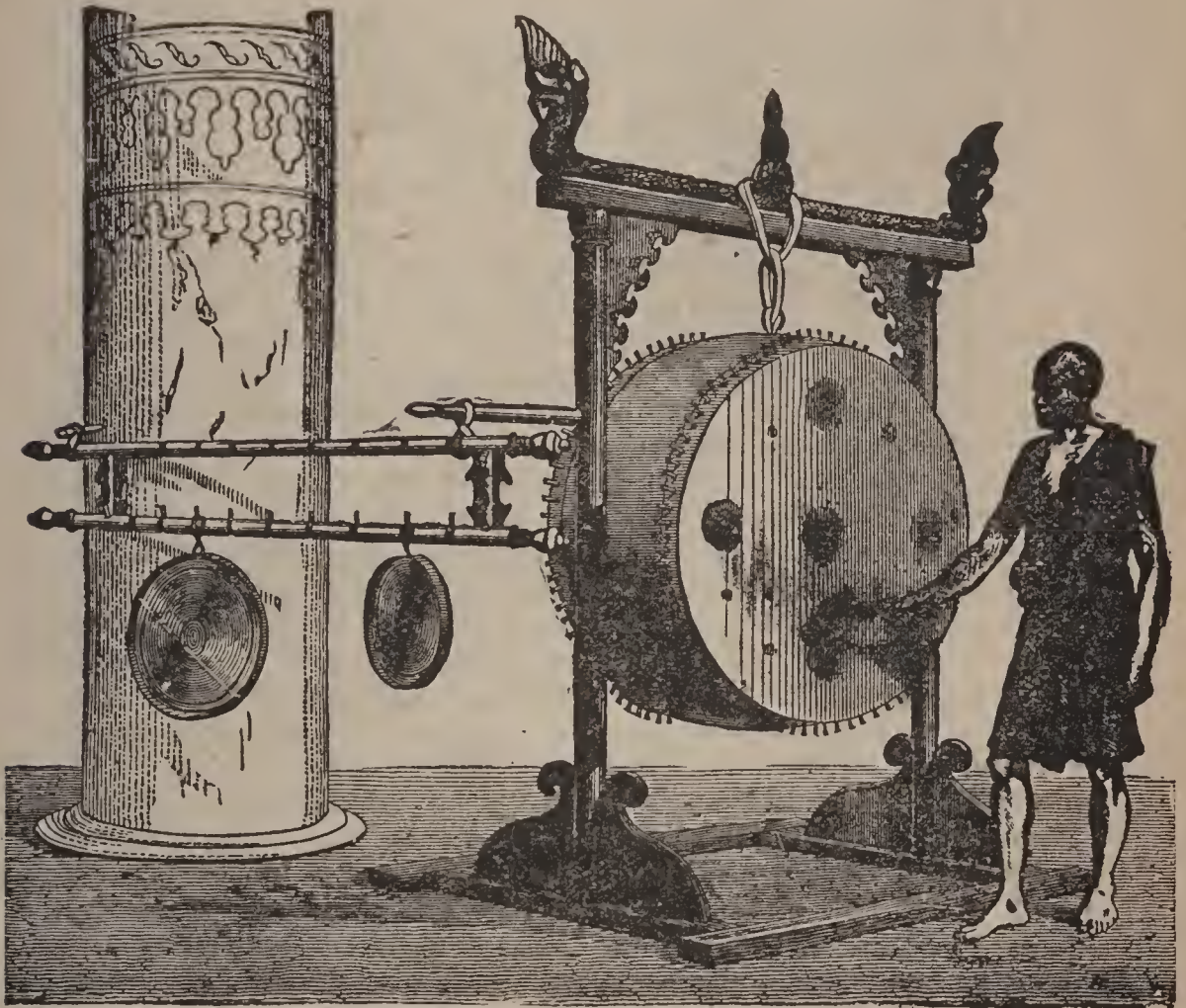
according to the Chinese ideas of beauty, are purchased by the rich at about twelve or fourteen years, for concubines, and are then instructed according to their master's ideas. The preliminaries, formalities, ceremonies and superstitions connected with marriage in China, would, if given in full, almost fill a volume. Previous to the wedding day the bride has her eyebrows pulled out, so that she is recognized ever afterward as a married



A CHINESE BABY IN ITS WINTER CRADLE.

woman. On the morning of the "lucky day" chosen for the marriage, she is carried from her home to that of her future husband in a beautiful and highly ornamented bridal chair. The religious part of the ceremony consists in the bride and groom's worshipping together the spirit tablets of the ancestors of the groom. The parties first see each other's faces when, seated by the bridal bed, the bride's veil is removed, and the two parties drink wine out of the same cup. The wedding festivities generally last at least two days. The first day the male friends and relatives of the groom are invited

to "shed their light" on the occasion. On the second day the female friends and relatives of the family of the groom are invited to the wedding feast. This is often called the "women's day." Not long after the family and guests have breakfasted on the morning of the second day, the newly married couple, amid the noise of fire-crackers, then come out of their room together for the purpose of again worshipping the ancestral tablets belonging to the household, the grandparents and parents of the groom. This custom is known by the name of "coming out of the room." Not long subsequent to this ceremony the people proceed to the kitchen for the purpose of wor-



BEATING ON A TEMPLE DRUM.

shipping the god and goddess of the kitchen. This is performed with great decorum, and is regarded as an important and essential part of marriage solemnities. It is believed that thus they will propitiate their good will, and especially that the bride, in attempting culinary operations, will succeed better in consequence of paying early and respectful attention to these divinities. This is an illustration of how idolatry is inwrought into the social and domestic life of the Chinese people.

When a baby boy is born in China friends and neighbors come together to rejoice, and throughout his tender years he is cared for most zealously. Many ingenious contrivances for the promotion of his health and comfort are procured, as witness the winter cradle shown in our illustration; but there is no gladness in a Chinese family at the birth of a little girl. Parents think

it a great disgrace to have only daughters in their family, and they fear the gods must be very angry to send them such a misfortune. And though it is almost too sad to believe, the little baby-girls are sometimes put to death by their own parents, who do not want the trouble of bringing them up. A Chinese girl is seldom taught to do anything but to use her hands, to cook, weave, do embroidery, etc. She is taken away when quite a child from her own father and mother *to be married*, and then, unless she belongs to the poorer classes, she is seldom seen outside the house of her mother-in-law. Indeed you will not wonder at this if you remember their strange custom of cramping the feet of women to make them small. The mother begins to bind the foot when the little daughter is only two years old, and the bandages are worn for years, though some children die of the cruel pain. At last the poor foot loses all feeling, but it is crippled and almost useless. The small-footed girl cannot walk any distance without the help of a stick, and her hobble must indeed be painful to see. Yet the Chinese admire the walk of small-footed ladies, and say it is like "the waving of willow boughs in a breeze."

The Chinese are so superstitious as to believe that the gods need very much the same things which we do, and are pleased with the things which give us pleasure; and so, in their folly, they try to send them money, clothing, furniture and houses. The wealthy send, in addition, summer-houses, sedan chairs, pleasure boats, etc. They do this by making paper or wooden representations of such things, and burning them in front of the idol or temple, they believing that they are severally changed into the real articles in the world of spirits for the use of the gods. Nearly all heathen people accompany their prayers to false gods with beating on some loud-sounding instrument. They seem to have the same idea concerning their gods as Elijah taunted the prophets of Baal with holding, namely, that Baal might be asleep and needed to be awakened by noise, or that he might be on a journey and need to be stopped in the same way. Before a Chinese worshiper enters a temple he gives a pull on the bell-rope to inform the god that he has come to worship, and to ask him to please give attention; and in all Buddhist countries while priests and people are engaged in worship, drums are beaten for the purpose of holding the attention of the gods. Sometimes these drums are within and at other times without the temple, and at other temples they are both within and without. The engraving we give shows the kind of drum used in Northern China, Thibet and Mongolia. Gongs and other loud-sounding instruments are also sometimes used in addition to the drums.

The prisons in China are in a much more revolting state than those in Europe were before John Howard began his labors for their improvement, and the prisoners who are not rich, or who have not rich friends willing to bribe the jailers, are given but a small amount of coarse food, and have to endure exceedingly cruel treatment. Comparatively few criminals, however, are imprisoned after conviction. Several crimes are punished with immediate decapitation, or strangulation, and others with tortures and flagellations. One method of punishment is that represented in the picture. The criminal is fastened in a crouching posture in what looks something like a cask, but with his hands and head outside, and this painful position he has to maintain day and night. In the illustration the wife of the criminal is represented as feeding him with rice by means of the Chinese chop-sticks. Other punishments are beating the cheeks with a leather instrument; squeezing the fingers; beating the person with a bamboo, or wooden stick; squeezing the ankles; standing on tip-toe in cages made of wooden slabs; wearing

a very tight-fitting shirt of iron wire, through which the skin and flesh protrude; and many others similar to those which were used in the Roman Catholic Inquisition.

Mandarins and other wealthy persons in China have extensive pleasure grounds connected with their residences in which are erected pavilions, or, as we would call them, summer-houses. We give an illustration of one of those found in the grounds of the Emperor's Summer Palace, near Peking.

Canton is one of the finest Chinese cities. Its narrow streets are filled with a stream of men and women as unceasing as the stream that flows over



A CHINESE MODE OF PUNISHMENT.

London Bridge daily. As you pass along the streets in a chair, it is one continual fight for passage room; and the various collisions that occur provoke groans on both sides from the chair-bearers and carriers of goods. Now a great basket of greens bumps against the sides, and now a pig enclosed in a basket is brought up against the chair, to the mutual alarm of pig and passenger. Presently another chair comes down in the opposite direction, and perhaps contains a portly mandarin in official garb. Then a great shouting ensues on both sides, and a tangle, in which the mandarin makes the most of the opportunity to look at the foreign lady. Then the chairs extricate themselves, and on patter the bearers. The streets present a very curious appearance, being hung with long, colored signboards, which have the appearance of banners streaming. Among these, glinting out

brightly in the sunlight, are gorgeous lanterns and colored lamps, so that the streets present a festive aspect even on ordinary occasions. The names of the streets are characteristic of Chinese inflation of style. One is called Street of Everlasting Love; another, Street of Refreshing Breezes; another, Street of a Thousand Beatitudes; another, Street of a Thousand Grandsons. Trades of all kinds are practiced in the open streets. There are traveling blacksmiths, hatters, joiners, umbrella makers, tinkers, tinsmiths, cooks, confectioners, lapidaries, barbers, doctors, dentists, jewelers, clothiers, and

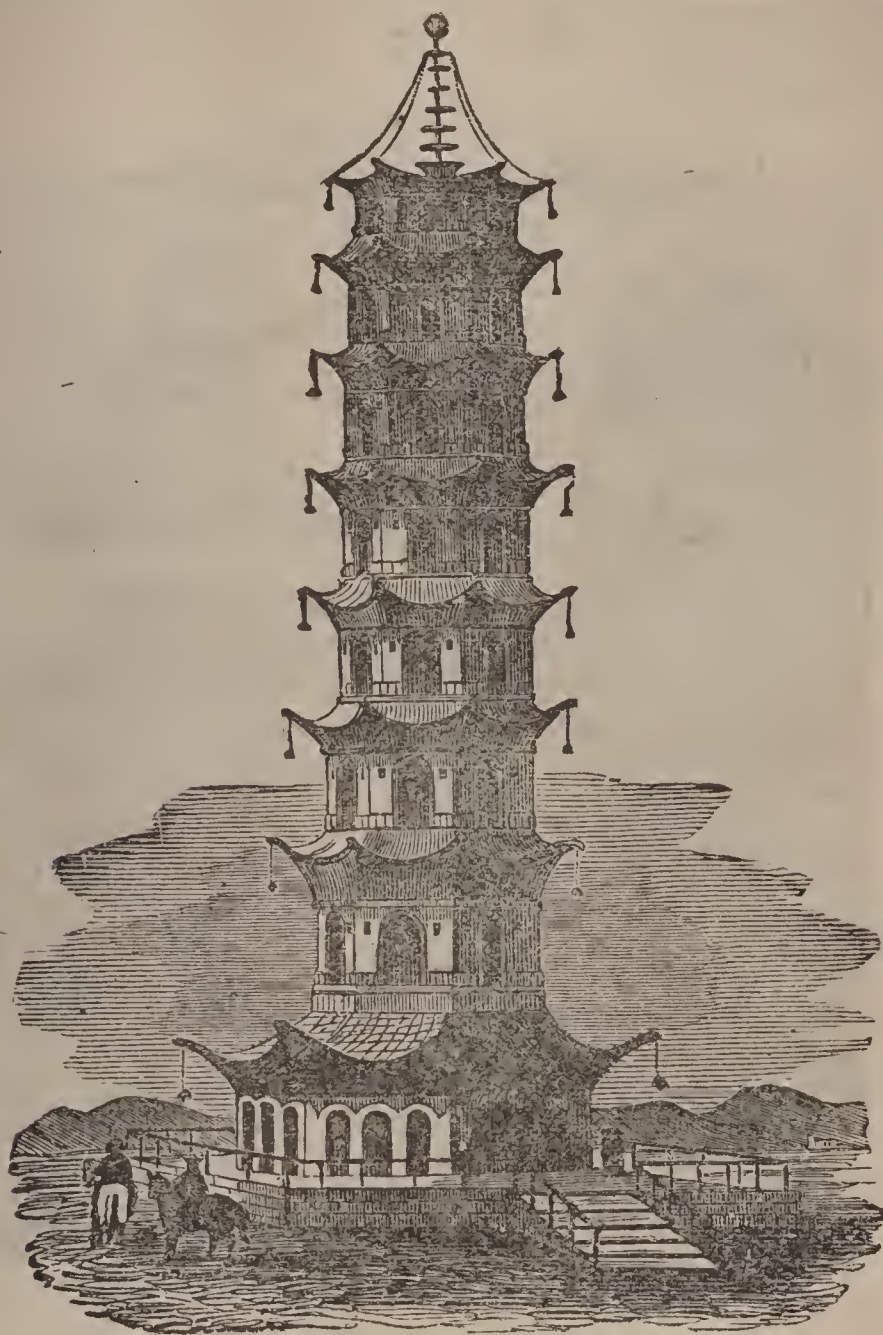


A CHINESE PAVILION.

cobblers. They all carry their shops about with them. If a customer wants his shoes mended, he will find his man at the first street, strike a bargain, take off his shoes, smoke the cobbler's pipe and wait. A few steps farther on he may doff his coat, and hand it for repair to a street tailor. Should he be afflicted with toothache while he waits for his coat, he may have his tooth extracted by some traveling dentist.

Nothing made Nanking so much celebrated abroad as the Porcelain Tower, which was one of the wonders of the world. It stood pre-eminent beyond all similar buildings for its completeness and elegance, and the quality of material of which it was built. It cost four millions of dollars, and was

nineteen years in building, being completed in A. D. 1430. The outer face of this unique structure was covered with slabs of porcelain of various colors, principally green, red, yellow and white. At every one of its nine stories there was a projecting roof covered with green tiles; and a bell was suspended from each corner. There were one hundred and fifty-two bells

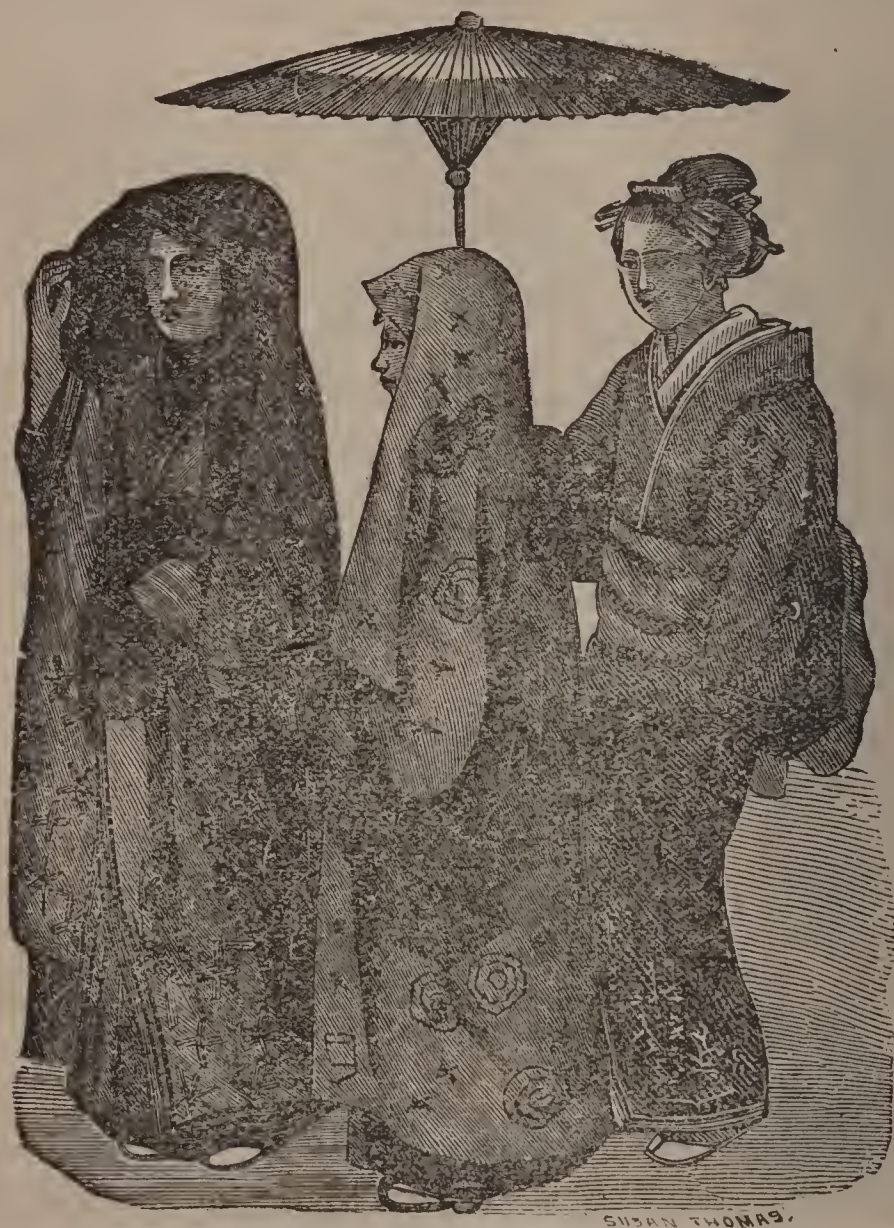


PORCELAIN TOWER.

in all, which gave sweet sounds when there was a brisk wind. One hundred and twenty-eight lamps were also hung on the outside. In the year 1801 it was seriously injured by a storm.

The Japanese.—As might be imagined from the character of the government, woman plays no part in the history of Japan, though, allowing for Oriental usages, she is treated on the whole with tolerable leniency. She occupies a better position in the family, from not entailing any charge of her marriage, as a bride receives no dowry, but, on the contrary, is pre-

sented by her husband with a handsome donation, which is invariably appropriated by her father. In Japan, therefore, it is considered more fortunate to have daughters than sons, as the former ultimately prove a very profitable investment. On the birth of a son, the event is commemorated by planting a tree, which, if the little stranger lives, is carefully tended to the day of his marriage, when it is cut down and furnishes material for a chest, designed expressly to hold the wardrobe of the newly-wedded couple.



JAPANESE BRIDE AND ATTENDANTS.

The marriage, as in China and Tartary, is an affair between the parents, and the wishes of the young people themselves are never consulted. The bride is usually in her fifteenth year; but maturity being early developed, wedlock may be contracted at a still younger age, and the mother is often a child herself. Marriage is a religious ceremony, and is celebrated with great pomp and many forms, in a public temple, in presence of the priests and idols, and the friends and kindred of both parties. The priest blackens the pearly teeth of the bride, using for this purpose the same indelible lacquer applied to coal-scuttles and other similar japan ware; and this serves,

from that time to her death, to notify, like the wedding ring of Europe, that she has entered the marriage state.

The husband has an absolute power over his wife; she is forbidden to interfere in anything whatever out of the house. "It is a just rule, recognized in the whole world," says the great legislator Yeyas, "that a faithful husband manages out-of-door business, and a faithful wife minds her household. When a woman thinks of outside affairs, her husband neglects his duties, and it forcibly leads to the ruin of the house. The hen must not



A JAPANESE FAMILY.

crow at dawn; it is a scourge, which every man jealous of his dignity and happiness should avoid." The husband disposes of the entirety of his wife's fortune; he can even sell her when hardly pressed by want; but it is right to add that he seldom takes advantage of this provision of the law for extreme cases. He can also repudiate her for a number of reasons. A divorced woman cannot take her children with her; but divorce is rare where there are children. She leaves the family of her husband, comes back to her own, and is allowed to marry again if she gets the chance, which is not frequently. Conjugal association, which in our societies has such a high

social importance, has but a very restricted one in Japan. There everything is expected from the woman, nothing from the man; for the former, marriage is a bond which death itself can scarcely sever; for the latter it is an association in which he will remain engaged only as long as he chooses.

Among the first things that strike the traveler in Japan are the wooden sandals worn by these thirty-five millions of people. They have a separate compartment for the great toe, and make a clacking noise on the street. Straw slippers are also worn, and a traveler setting out on a journey will strap a supply of them on his back that he may put on a new pair when the old ones are worn out. They cost but a cent and a half a pair. They are never worn in the house, being left outside the door; passing down a street you see long rows of them at the doors, old and new, large and small. It



A JAPANESE BED.

is surprising to see how readily the Japs step out of them, and pick them up again with their feet, without stopping, when leaving the house. Constant habit makes them dexterous.

The inside rooms of the houses are all of a certain size, so that the mats with which the floors are covered fit snugly. These mats are braided of rice straw, which is really the universal material of the Japanese, as the European art of making household furniture, such as beds, tables, chairs, divans, etc., is not yet developed. On these mats they take their meals; and family gatherings, and in fact all visitors, find a soft and welcome spot. On one of these mats can be seen the "shake down" bed, which is the universal couch of repose, with its hard bamboo pillow, than which nothing could certainly be more uncomfortable to people accustomed to the soft and downy pillow of civilization.

The Japanese priests, and also of the Buddha religion, are recruited principally from the higher classes, and a small portion from the higher

middle classes. Around each one there seems to be a distinct social clan. The Cinto priests live in small-built houses near the temple. They allow their wives to assist in their priestly duties. Much better, however, live the



A JAPANESE TEMPLE.

priests of the various branches of the Buddha religions. They have large revenues and live a luxurious life; therefore the least said of their morality the better.

A traveler thus describes the arrival at a Japanese hotel: The landlord comes to meet us, falling on his hands and knees, bows his head to the floor. One or two of the pretty girls out of the bevy usually seen in the Japanese hotels come to assist us and take our traps. Welcomes, invitations, and plenty of fun greet us as we sit down to take off our shoes, as all good Japa-

nese do, and as those filthy foreigners don't, who tramp on the clean mats with their muddy boots. We stand up unshod, and are led by the laughing girls along the smooth corridors, across an arched bridge, which spans an open space in which is a rookery, garden, and pond stocked with gold-fish, turtles, and marine plants. The room which our fair guides choose for us is at the rear end of the house, overlooking the grand scenery for which Kanosan is justly noted all over the empire. Ninety-nine valleys are said to be visible from the mountain top on which the hotel is situated."

The Castes and Tribes of India.—In India only four pure castes are recognized, the Brahmin or priests, the Kshatriyas, who are soldiers, the Vaisyas as husbandmen, and the Sudras as servants or laborers. Heeren supposed that the first three were a foreign race, who subdued the aborigines of the country, and reduced them to an inferior caste. These four classes con-



THE HINDOO.

stitute the elements of every society in an early period of civilization. Professor Wilson says that everything in the Hindoo institutes indicates that the Brahmins originated not from political but religious principles. "Apparently," he says, "the system was contrived by a religious confederation as the scheme best adapted to introduce order among semi-civilized tribes, and with no view to their own advantage, or aggrandizement or enjoyment of indolent ease. The authority of influence, of advice, the Brahmins necessarily retained, and they were the only competent expounders of the laws which they promulgated. They had no other means of protection than the character of sanc-

tity with which they invested themselves and which was equally necessary to insure attention to their instructions. They labored to deserve the opinion of sanctity by imposing burdensome duties on themselves of a domestic and religious character." In the very rudest constitution of society the priest is to be found. In addition to the influence which he professes to have with good and evil spirits, he sometimes practices the medical art, and in various ways sustains his importance by superior cunning, working upon the superstition, ignorance, and fears of man in his most abject condition. Nowhere has the influence of a priesthood been so paramount and extensive as in Hindostan. It is remarkable that the Brahmins never invested themselves with royal authority. The laws of Menu direct that "To one learned Brahmin, distinguished among the rest, let the king impart his momentous counsel." As the sole interpreters of the laws, they in reality possessed the judicial powers of government as well as those of a legislative character. The code was already perfect and complete, as coming from the Divine Being, and in no case could it be interpreted except in the sense the Brahmins were pleased to impose. The king was little more than a servant of the Brahmins. In order to have an adequate idea of the superiority of the

ancient Brahmin, we must refer to the laws of Menu, which were probably promulgated three thousand years ago. While the Sudra, the lowest of the four castes, was represented as proceeding from the foot of the Creator, the Brahmin came forth from his mouth. He is declared to be the lord of all the classes, and from his high birth alone is an object of veneration even to deities, and it is through him, and at his intercession, that blessings are bestowed upon mankind. "When a Brahmin springs to light, he is born above the world, the chief of all creatures," the first duty of civil magistrates is to



A BRAHMIN EXPOUNDING THE VEDA.

honor the Brahmins. "Whatever exists in the universe is all in effect, though not in form, the wealth of the Brahmin, since the Brahmin is entitled to it all by his primogeniture and eminence of birth." The sacred books are exclusively his; and while the other classes are scarcely permitted to read them, he is appointed their sole expounder. For offering to give instruction to Brahmins, hot oil must be poured into the offender's mouth and ears, and for contumelious language the punishment is almost as severe. Mysterious powers were assigned to them. "A priest who well knows the law, need not complain to the king of any grievous injury, since, even by his own power, he may chastise those who injure him; his own power is mightier

than the royal power." Again, it is said, "Let not the king provoke Brahmins to anger, for they once enraged, could immediately destroy him," and it is asked, "What man desirous of life, would injure those by the aid of whom worlds and gods perpetually subsist, those who are rich in the knowledge of the Veda?" Extraordinary respect must be paid to the most humble Brahmin. "A Brahmin whether learned or ignorant is a powerful divinity." To confer gifts upon Brahmins was an essential religious duty. These gifts were a necessary part of expiation and sacrifice. The Hindoo ritual, as



THE BHEELS.

Mr. Hill remarks, extended to almost every hour of the day and every function of nature and society, and consequently, those who were the sole judges and directors of its complicated and endless duties could not but be possessed of an enormous influence on the mental character of the people.

The Bheels are the original inhabitants of the western part of India; at some remote period, beyond the reach of historical records, they were driven from the plains, and now inhabit the wild tract of country which separates Malwah from Nemaar and Guzerat. While the history of the

Bheels naturally excites curiosity, their dispersion over rugged tracts of country, and their ignorance and prejudices, are obstacles to intercourse; and little is known concerning their habits, customs and forms of worship, except that they are different from those of other races of India. The word "Bheel," which signifies a robber or plunderer, is applied generally to the people who dwell in the mountains of Central India, and amid the thickets on the banks of rivers; but used comprehensively in this manner, it includes many who are not real Bheels, though they have adopted their predatory habits. Sir John Malcolm divides the Bheels into three classes—those who live in villages, the agricultural Bheels, and the wild Bheels of the hills. "The first," he says, "consist of a few who from ancient residence or chance have become inhabitants of villages on the plain (though near the hills), of which they are the watchmen, and are incorporated as a portion of the community. The cultivating Bheels are those who have continued in their



THE MAHRATTAS OF INDIA.

peaceable occupations after their leaders were destroyed or driven by invaders to become desperate freebooters; and the wild or mountain Bheel comprises all that part of the tribe, who, preferring savage freedom or indolence to submission and industry, have continued to subsist by plunder. The wild Bheel are a diminutive, ill fed, wretched looking people, though they are active and capable of great fatigue. The village Bheels are faithful and honest, and those who live by cultivation are industrious, but rude in their manners, easily assimilating to their wilder brethren. The rude religion of the Bheels bears some resemblance to that of the Hindoos, but they excite horror of the latter by eating the flesh of the cow. Their ceremonies are chiefly propitiatory, consisting of offerings to the minor infernal deities of the Hindoo mythology.

In the latter half of the seventeenth century, in the reign of Aurungzebe, the last powerful and energetic monarch who ruled over the Mogul empire

in Hindostan, there descended from the range of inaccessible hills which runs along the western coast of India fierce and wild bands of plunderers, whose devastating excursions spread dismay among the inhabitants of the neighboring plains. They were the Mahrattas. Aurungzebe died in 1707, when the Mogul dominion declined with frightful rapidity. The Mahrattas now extended their territories, their original country, though large, being wild and uncultivated. From robbers the Mahrattas became conquerors. Half the provinces of the empire were turned into Mahratta principalities. Freebooters sprung from low castes and accustomed to menial em-

ployments became mighty rajahs. The Bouses, at the head of a band of plunderers, occupied the vast region Berar. The Guicowar, which is, being interpreted, the Herdsman, founded that dynasty which still reigns in Guzerat. The House of Scindia and Holkar waxed great in Malwah. One adventurous captain made his nest on the impregnable rock of Gooti; another became the lord of the thousand villages, which are scattered among the green rice fields of Tanjore. The formidable confederation of the Mahrattas was put an end to in 1817, after a struggle maintained for many years against the British power in India.

There is a class of Hindoo women whose fame has extended far beyond their native



A NATIVE MUSICIAN OF INDIA.

land, and whom poets have depicted, not without exaggeration, as most refined and poetic beings. We allude to the Nautch girls, or Bayaderes, whose songs and dances are in great request throughout India, and are essential to the proper performance of certain religious rites. Men accompany the movements of the dancers with trumpets and cymbals, while other Bayaderes, who sit around in a circle, beat time with their hands, and sing a monotonous refrain. The effect of the dance is produced less by the grace of the dancer than by her gay-colored garments and the profusion of jewelry with which she is literally loaded. Their costumes are always rich,

and arranged with a considerable degree of art. One of the most effective is composed of a jacket very low in the neck, trousers, and a long veil which floats about the entire body.

The Banjara women are noted for their beauty; slender, with finely formed limbs, and a noble expression, each of their movements displays pride and grace. Their dress is a short jacket, and a long plaited robe.



NATIVES OF BANJARA, INDIA.

Over the pointed head-dress a cloth is thrown, which falls down the back, and envelopes the figure like a cloak. Their jewelry often represents the entire capital of their husbands. They wear rings in the nose and ears, rings and chains braided in their hair, and bands of shells, and red and blue ivory rings upon their arms. Upon their ankles they load heavy metallic rings hung with many little bells. These walking jewelers' shops

present a truly picturesque appearance throned upon camels, their garments flowing in graceful folds, and holding a child in their arms. The position of these women is far from happy. In their wanderings the care of the herds falls entirely upon them, the men contenting themselves with patrolling the camps, and protecting them against the attacks of robbers and wild animals.

At the threshold of India, in the northwestern angle of the Himalayan



WOMEN OF THE HIMALAYAS.

mountain chain, lies the renowned province of Cashmere, surrounded by ranges of snow-clad mountains, some of which are the loftiest known. Its deep secluded valleys are carpeted with the richest flowers and the most luxurious vegetation. Waterfalls dash in musical cadence from the cliffs, and numerous lakes reflect and multiply the magnificent landscapes which surround them on every side. The people who inhabit this paradise are

usually handsome, with faultless physical proportions. Their rather prominent noses scarcely detract from the glorious beauty of their sparkling eyes. The women, however, are fickle and crafty, and the keen tongue of a Cashmere beauty is as much dreaded as her caprice.

The magnificence of the Taje Mahal and the "City of Palaces," Calcutta, lead us to a somewhat exaggerated idea of the splendor of India and its advancement in the scale of civilization. Many think it has risen out of its legends and superstitions since ruled by the British crown, and so fail to consider that it is still, to a large extent, governed by its native chiefs, and consequently retains most of its old customs and strange laws of caste and peculiar religious rites. One of these idolatrous rites is represented in our



SUTTEE WORSHIP, INDIA.

illustration of Suttee worship, which is preceded one month by noisy festivities, and as the day of the sacrifice approaches, the offering is decked with flowers and a weird dance is held around her, after which the offering to this feast is bound to the holy stake. The priests then recite the ritual forms, informing their gods that upon the next day the sacrifice will be made, and a human life will go out from the dark heathenism of India with its beautiful Vale of Cashmere.

Our next illustration, primitive as it may appear, represents a better civilization. Although English coaches and Hansom cabs have been introduced into the larger cities, yet when one arrives in what we call the country towns, there is found the zebu carriage in all its glory, drawn by animals representing a cross between an ox and deer, with fatty protuberances on its



ZEBU CARRIAGE, INDIA.

shoulders. The carriage resembles a dog or village cart, and possesses a canopy to protect the occupant from the rays of the Indian sun. The driver, seated almost on the bovines' haunches, shouts vigorously from time to time at the animals, with little result as to speed.

The natives of Scinde, India, dwelling on the shores of the Indus, have a very primitive and original method of taking the fish necessary for their



MODE OF FISHING IN INDIA.

subsistence. The fisherman launches into the water a large and very light earthen vessel, and lying face downward upon it, commends himself to the mercy of Allah and pushes off from the shore. Impelling his singular bark forward with his feet and hands, he skims over the water, as our engraving on preceding page represents. He holds in his right hand a pitchfork about fifteen feet long, to which is attached a large net, which he closes immediately the fish is taken, and transfers the fish to his vessel. Floating with confidence over the water, the fisherman pro-



SENEGAMBIA FULAHS.

ceeds several miles from the shore, suffering himself to be carried forward by the current on account of the *puia*, a fish in much esteem, always swimming against the stream. Others content themselves with fishing for the *puia* with a net, standing on the shore.

Life in Africa.—Senegambia is the name given to that portion of Western Africa which is watered by the two great rivers of Senegal and Gambia. The face of this large tract, which extends interiorward to the distance of six or seven hundred miles, is generally flat and monotonous. The princi-

pal native tribes of Senegambia are the Jaloffs, the Mandingoes, and the Fulah. The Fulahs of Futa-Jallon differ very materially from the ordinary negro races, and can scarcely be classed in the same family. Their complexion is a brownish black, with hair soft and curly, foreheads good, lips thin. In stature they are of middle size, limbs delicate but well formed, and in gait graceful and independent. The Fulahs have a tradition that they are descended from Phut, the son of Ham. They are Mohammedans, and are zealous in proselyting the heathen tribes.

The Sourigo, also natives of West Africa, are a warlike and savage race,



THE SOURIGO, NATIVES OF WEST AFRICA.

and, unlike the Fulahs, their skin is extremely black, their lips thick and their countenance repulsive. They have frequently been known to attack and kill travelers from apparently no other motive than pure wantonness.

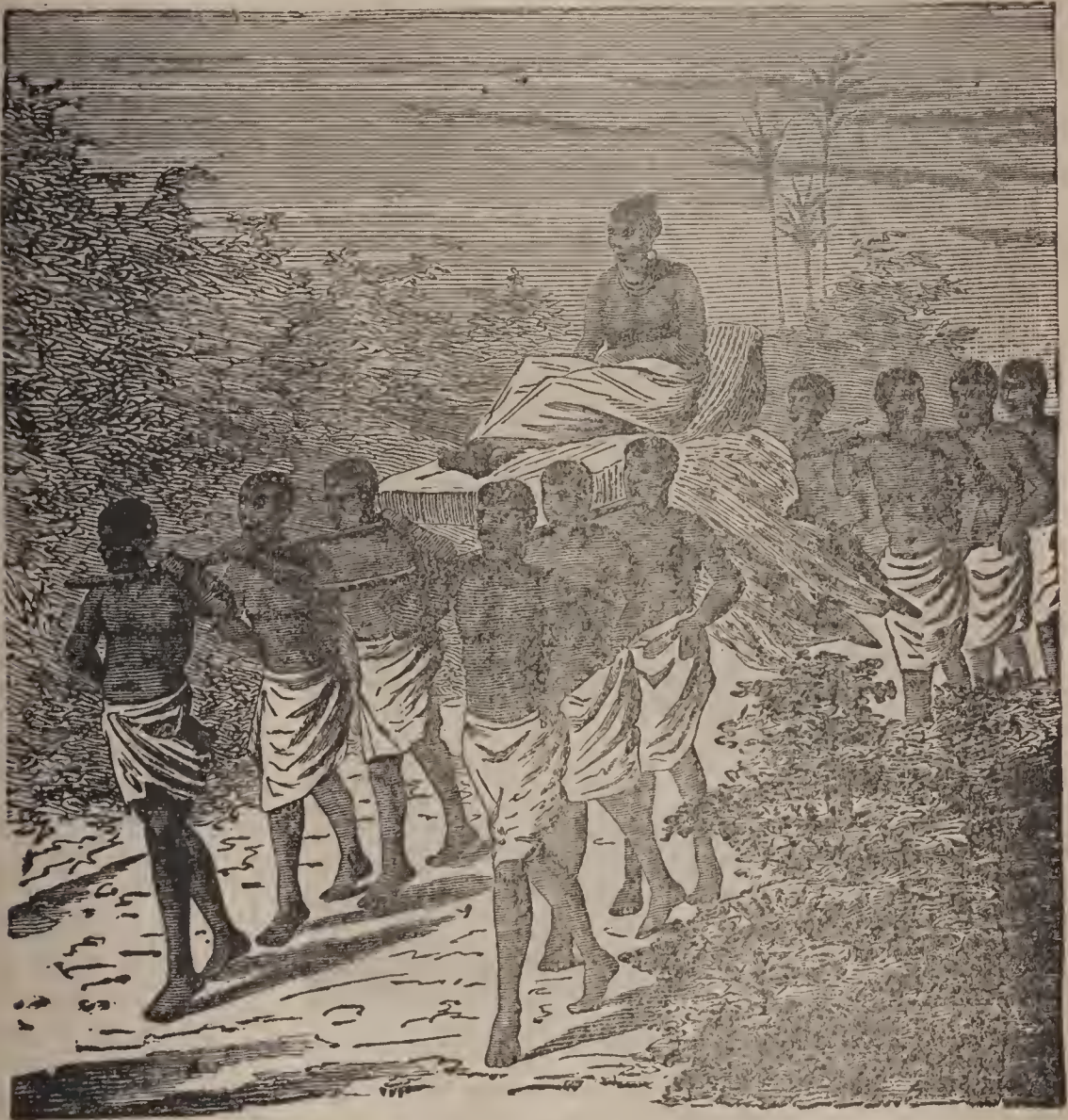
Congo women are not better treated than women elsewhere in Africa. Indeed, it is said that one of the greatest marks of affection which a husband can bestow on his wife is a good horse-whipping, and that a Congo wife considers herself very badly used, and her relatives remonstrate with her husband, if she does not receive the chastisement at regular intervals. A woman, however, may ascend the

throne, and the reign of one named Shinga, who came to power in 1640, fills a considerable chapter in the unwritten annals of Equatorial Africa. Through the intrigues of Jesuit priests, to whose rites she would not submit, she was forced to fly the kingdom, after contending with her nephew in three pitched battles, which she lost. In 1646 she regained her kingdom after many vicissitudes of fortune. By this time she had got so accustomed to war that she cared for nothing else, and her life was spent in hostilities against her neighbors. Before she undertook any new enterprise she would sacrifice the handsomest man she could find.

In nearly all parts of Africa the most rigid distinctions of caste are enforced. When a native approaches his superior, he prostrates himself upon

the ground, burying **his** head in the earth, and durst not arise from this position until the greater man has passed.

The Bakalaharis are a timid race, encountered by Dr. Livingstone in his expedition of South Eastern Africa. The constant dread of being attacked by savage tribes drives them to a distance from rivers or lakes. When they by chance discover a small pond they cover it up with sand. The women, when they are in need of water, place in a net which they carry on their backs twenty or thirty empty ostrich eggs, which serve as vases. They then



CHIEF'S WIFE TRAVELING, CENTRAL AFRICA.

attach to the end of a reed two feet long a tuft of herbage, which is thrust into a hole in the moist ground, the surrounding space being closed up by the moist earth. By applying their lips to the exposed end of the reed, the water is drawn into their mouths, and thence transferred by another reed to the ostrich eggs.

Cameron's "Across Africa" says that on the death of a Urna chief it is the custom "to divert the course of a stream, and in its bed to dig an enor-

mous pit, the bottom of which is then covered with living women. At one end a woman is placed on her hands and knees, and upon her back the dead chief, covered with his beads and treasures, is seated, being supported on either side by one of his wives, while his second wife sits at his feet. The earth is then shoveled in on them, and all the women are buried alive, with the exception of the second wife. To her, custom is more merciful than to her companions, and grants her the privilege of being killed before the huge grave is filled in. This being completed, a number of male slaves—sometimes forty or fifty—are slaughtered, and their blood poured over the grave, after which the river is allowed to resume its course."

Upon the death of any man of position or wealth in Madagascar, on the



SALUTING A SUPERIOR.

day of the funeral the wife is placed in the house, dressed in all her best clothes, and covered with her silver ornaments, of which the Sikanaka wear a considerable quantity. There she remains until the rest of the family return home from the tomb. But as soon as they enter the house they begin to revile her with the most abusive language—telling her that it is her fault that her *wini-anu*, or fate, has been stronger than that of her husband, and that she is virtually the cause of his death. They then strip her of her clothes, tearing off with violence the ornaments from her neck, arms and ears. They give her a

coarse cloth, a spoon with a broken handle, and a dish with a foot broken off, from which to eat. Her hair is disheveled, and she is covered up with a coarse mat. Under that she remains lying all day, and can leave it only at night; and she may not speak to any one who goes into the house. She is not allowed to wash her face and hands, but only the tips of her fingers. She endures all this sometimes for a year, or at least for eight months; and even when that is over the time of mourning is not ended for a considerable period, for she is not allowed to go home to her own relations until she has first been divorced by her husband's family.

Religious Customs in Palestine.—An English gentleman who has lately traveled in Palestine, recently gave a description of the curious scenes that are enacted in the church of the Holy Sepulchre. He said that when you first entered the church, you would be surprised to see a party of soldiers, with their swords by their sides, and their guns stacked within reach. It seemed a sacrilege in such a holy place, and struck one rather unpleasantly. But he soon found out the necessity for it. According to the law of the country, every sect is allowed to worship there; and as it is considered equally sacred both by Christians and Mohammedans, all wish a time for their mode of worship. The law allows them an hour each. They commence at six in the morning. At that hour, those who have the first privilege enter, bringing with them whatever is necessary to conduct their particular religious rites. They go through their prayers and chants, and all is very quiet till about a quarter to seven, when those who have the privilege of the next hour begin to arrive. At first, all is decorum; but presently the new comers begin to hiss and mock. As their numbers increase, and they become stronger, they get more and more bold. A few minutes before seven, they proceed to more forcible demonstration.



BAKALAHARI WOMEN FILLING WATER SKINS.

They think, if they can clear out these blasphemers a few minutes before the time, they have done so much good work for God; while the worshippers, on the other hand, think, if they can keep possession a few minutes after the time, they have done an equally good work. As some of these sects use torches, wax candles, staves or crooks, in their worship, they proceed to use these as weapons of offense or defense, and a regular *mêlée* ensues. Then come in the soldiers, who separate the combatants by filing in between them, turning out those whose hour is up, and leaving the place in possession of the last comers. If blood is shed the church is closed for the day. Such scenes are occurring all day long, and the presence of soldiers is therefore absolutely necessary.

The Arabs.—The passion of the Arab lover exhausts itself upon the maiden; it never extends to the wife. His wooing is most ardent, and all his war songs are intermingled with thoughts of his mistress; but the Arab woman's married life is prosaic in the extreme—indeed she is little better than the slave of her husband. The Bedouin marriage ceremony is usually as follows: After the wooing, which is mostly done with a friend of the father of the intended bride, the time is fixed for the wedding feast, ordinarily five or six days after the betrothal. On the wedding night young men chosen for the purpose kindle a fire before the tent of the bride, around which they



A FAMILY OF BEDOUINS.

gather and discharge their muskets, at which the women set up their shrill "*Elnuta wahal*," or song, each strophe of which is accompanied with a peculiar shout, the thrilling "*li-li-li-li*" of the chorus ringing away over the steppes, inviting the occupants of the most distant tents to collect around the bridal-fire. Each takes up the shout, the desert resounds with the marching call, "*Isru*," and men and women rush together, amid the deafening din of yelp, and shriek, and the discharge of musketry. After a while the disorder ceases and is followed by songs. The older people sip their coffee and smoke, the younger members of the party dance, and the women keep up their ear-splitting "*Sagruta*" far into the night. Among many of the Bedouin tribes, the bridegroom comes and snatches his bride and carries her away by force, either from her own tent or that of a neighbor, or, as with the Bedouins of Sinai, from the mountain where she has hidden her-

self. It is considered entirely correct for the bride to escape from her husband's house if she can.

Among the Arabs the dress for men and women differs but little, many garments being worn in common, varied only by the manner of putting them on. A tunic, coat or inner garment is usually made of two pieces of linen, sewed together at the sides, and it reaches to the knees. The abba, or ordinary outer garment, is an oblong piece of woollen cloth, about five yards long by five feet wide. It can be wrapped around the body or worn over the shoulder like a shawl, with the ends of the "skirt" hanging down in front. A long tunic without sleeves is sometimes worn, as a third garment, between these two. Changes of garments constitute an important part of a man's wealth.

The wandering Arab tribes of the present day dwell in tents. If possible, these are pitched near the shade of a tree. The larger tents are divided into three apartments, the inner of which is given to the women, and the outer to the servants, with the young of the herds. An Arab camp is always circular in form and removed at a distance from the central tent of the chief.

The "simoon," or poison wind of Arabia, is a serious affair to the persons caught in it. The center of the column of wind is composed of a poisonous gas, to breathe which is death. Round this center there eddy violent gusts of heated



ARAB DRESS.

and impregnated air, like that of a furnace. It approaches slowly amid the whirl of air currents that precede it for some distance. During its presence the only chance of preserving life is found in covering the face with a cloth and lying prone on the sand, inhaling what little pure air may be found next to the earth. Meanwhile, the feeling of the chest is that of suffocation, and that of the limbs as though molten iron was being poured over them. Camels instinctively bury their nozzles in the sand; but horses do not possess the same preservatory instincts, and often perish in consequence.

Female Beauty.—The ladies of Arabia stain their fingers and toes red, their eyebrows black, and their lips blue. In Persia they paint a black streak around their eyes, and ornament their faces with various figures. The Japanese women gild their teeth, and those of the Indians paint them red. The pearl of the tooth must be dyed black to be beautiful in Guzerat. The Hottentot women paint the entire body in compartments of red and black. In Greenland the women color their faces with blue and yellow, and they frequently tattoo their bodies, by saturating threads in soot, inserting

them beneath the skin, and then drawing them through. Hindoo families, when they wish to appear particularly lovely, smear themselves with a mixture of saffron, tumeric and grease. In nearly all the islands of the Pacific and Indian Oceans, the women, as well as the men, tattoo a great variety of figures on the face, lips, tongue and the whole body. In New Holland they cut themselves with shears, and keeping the wounds open a long time, form scars in the flesh, which they deem highly ornamental. Another singular mutilation is made by taking off, in infancy, the little finger of the left hand at the second joint. In ancient Persia, an aquiline nose was highly prized; but the Sumatran mother carefully flattens the nose of her daughter. By some of the savage tribes in Oregon, and also in Sumatra and Aracan, continual pressure is applied to the skull in order to flatten it, and thus give it new beauty. The modern Persians have a strong aversion to red hair. Turks, on the contrary, are warm admirers of it. In China, small round eyes are

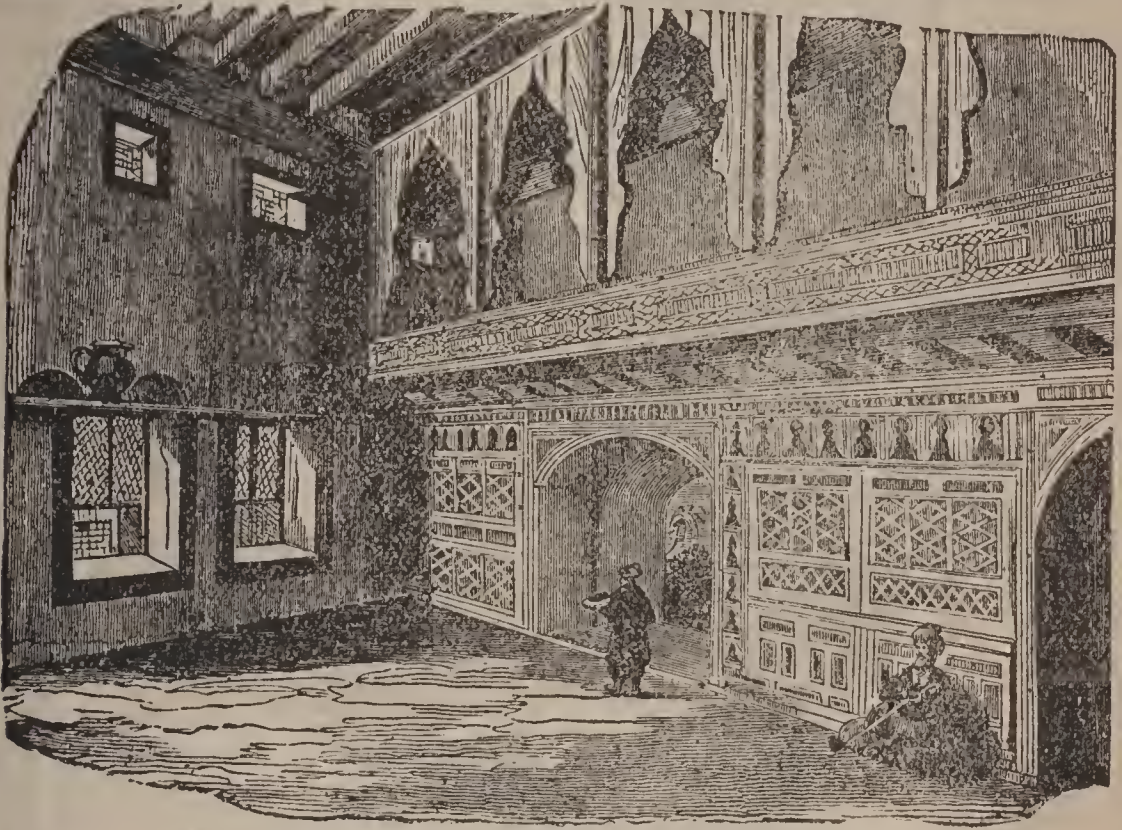


AN ARAB TENT.

liked, and the girls are continually plucking their eyebrows, that they may be thin and long. But the great beauty of a Chinese lady is in her feet, which in her childhood are so compressed by bandages as effectually to prevent any further increase in size. The four smaller toes are bent under the foot, to the sole of which they firmly adhere; and the poor girl not only endures much pain, but becomes a cripple for life. Another mark of beauty consists in finger nails so long that casings and bamboo are necessary to preserve them from injury. An African beauty must have small eyes, thick lips, large flat nose, and a skin beautifully black. In New Guinea the nose is perforated, and a large piece of wood or bone inserted. In the north-west coast of America an incision more than two inches in length is made in the lower lip, and then filled with a wooden plug. In Guinea the lips are pierced with thorns, the heads being inside the mouth, and the points resting on the chin.

Turkish Life and Customs.—On entering within the gates of a Turkish house the scene forms a striking contrast with the dull, sombre ex-

terior. An open court, often paved with beautiful marble slabs, and always, when the weather is fine, covered with matting, shelving terraces, and parterres of flowers round parts of this court, and gaily-painted alcoves, galleries, pillars, and the hanging roofs of the apartments flanking the court in other parts. The ground floor is given up to the kitchen, offices, and the servants. The upper or grand apartment is divided into two. One of these divisions is occupied by the master of the house, and is open to all male servants and visitors; the other, called the harem—which word signifies a “holy place”—is devoted to the women. The rooms of reception that open upon the great corridor are spacious, seldom very lofty, and always plain. The ceilings of the rooms, which are among the most ornamental portions of a Mussulman’s apartment, are exceedingly beautiful. Indeed, in many



INTERIOR OF A TURKISH HOUSE.

houses it seems as if all art and ornament were reserved to be lavished on the ceiling. It is formed of curiously tessellated wood-work, at times representing a mosaic in wood, dotted here and there with golden stars; at times painted in the arabesque style with green, blue, and gold, and in the most varied and complicated designs.

Nothing impresses a stranger with the difference between Constantinople and even the smallest western town, more forcibly than the almost total absence of carriages, and the contrast between those that are seen and any that have ever been met before. The native coach is resplendent with yellow, and the canopy decked with numberless red tassels, which are repeated with the addition of bells on the harness of the mule, and a more thoroughly uncomfortable machine in which to go a pleasuring than a *telekah* can hardly exist. The narrowness of the road obliges one carriage to come to a standstill while another passes; this enables one to see the veiled ladies seated, of course, *a la Turque*. It is a rare picture that we view from our

window; it consists of a large square full of fountains, grass plots, flower-beds, gilded cages, vases filled with roses and clinging vines, hanging-baskets that shine like gold, while here and there servants or guests, in picturesque garments, move about with languid, indolent grace. There is an old grandfather Turk standing under the doorway; his servant spreads a beautiful mat at his feet, and brings him an Oriental pipe. His head has long silver-white locks, and such a beard! It positively etherealizes smoking to see it enjoyed in that manner. If you want to succeed among Orientals, you must never show yourself to be in a hurry. Lemonade, sweetmeats, coffee, and pipes are served with great formality on the streets, and



LIFE IN CONSTANTINOPLE.

at all hours can be seen the native smoking accompanied by no end of dogs, which are more numerous in the streets of Constantinople than the sands of Egypt.

In a Turkish house the men and women do not take their meals together, do not sit around a table, and can hardly be said to feed decently. It is quite possible for men and women who do not know the use of a fork to be very clean about their food, but the use of a fork is a great step toward cleanliness in eating. A Turk holding a considerable position in the State will take a handful of boiled rice from the common dish, and after having squeezed all the water out by working it well in his hands, will put the lump

into the mouth of a guest as a mark of peculiar favor. There is a slovenliness about Turks at their meals which is probably due to the fact that men and women do not take their meals together. The object of the meal is solely to eat.

Turkish women have oval faces, clear olive skins, languishing dark eyes, and beautiful hands, soft as velvet and white as snow—beyond this, nothing. They lack the natural grace and pretty coquetry of Levantine belles, the firm tread, elegant manners and becoming modesty of European women. Their figures are clumsy, their features somewhat harsh, their lips full and often thick; they walk with a roll (their legs being bowed), and even their natural attractions depend more or less upon artificial aid. They thickly powder their faces, blacken their brows, and dye their eyelids and lashes, so that when half veiled by the yashmak screen they are certainly striking and present a dazzling effect; but under other circumstances most of them would pass unobserved. Many of the children are beautiful, with round, rosy, plump faces and golden brown hair; their dress is, however, frightful and ridiculous; they wear wide pantaloons and long skirts of some outrageous color (often yellow), badly-fitting shoes and a smartly-colored cap perched on the tops of their heads.

A Turkish wedding is thus described: "The bride was dressed in white silk, brocaded with silver and pearls, and around her waist was a belt containing a fortune in precious stones. Her cheeks were painted a deep crimson, laid on in a heart shape, and another heart was painted on the chin, the rest of the face white as luminous cosmetic could make it. The eyebrows were painted intensely black; they met, and were stretched to the temples. Her fingers were dyed deep crimson, and her long, black hair was braided full of little jingling coins. Her little feet were shod in velvet slippers, embroidered with pearls, and she wore great diamond earrings. After drinking coffee—which the writer would fain immortalize, it was so very precious—and gulping down some rare Turkish bonbons, mixed with paste and paregoric, they inspected the trousseau of the bride. The chief priest who performed the ceremony was blazing with jewels, and wore a costly mitre. He kept the poor little bride waiting three whole hours while he was attending another wedding, but the people seemed to bear the delay with patience. The bride was rather under the ordinary height, and the bridegroom a very tall man, and they were obliged to stand with their foreheads touching each other during the entire ceremony, which took a whole hour. After the ceremony the bride was placed on a high chair, and the bridegroom came forward with a richly-trimmed cushion bearing the bridal presents—a watch and chain, a diamond brooch, earrings, necklace and bracelets, and a large knitted purse filled with gold. The bridegroom parted the great veil which hung over the new wife, and adorned her with the jewels. Then she was lifted by men and seated astride a small barrel of wine, and the feast commenced. She was obliged to sit there till all the wine was drank out of the barrel, which was nearly two hours. She looked tired enough, and it was daylight before the feast was ended and the bride borne away."

The marriage of princesses, on whose expenses, as the Hatti Hamayoun of 1858 stated, no saving could be effected, deserves special notice. If one of the sultan's daughters has attained the age at which Turkish girls are generally married, the father seeks a husband for her among the nobles at his court. If a young man specially pleases her, he is given the rank of lieutenant-general, nothing lower being ever selected. The chosen man receives, in addition, a magnificent fully-furnished palace, and sixty thou-

and piastres a month, pocket money; and, in addition, his father-in-law defrays all the house-keeping expenses. The bridegroom is not always over and above pleased at being selected. If he be married, he is obliged to get a divorce—he must never have a wife or mistress in addition to the princess; and, moreover, he is regarded as the servant rather than the husband of his wife. The sultan himself announces to him his impending good fortune, and it is his bounden duty to bow reverentially, kiss the sultan's feet, and stammer a few words about the high honor, the unexpected happiness, etc. He then proceeds with a chamberlain, who bears the imperial Hatt to the sublime porte. A military band precedes him, and soldiers are drawn up along the road, who present arms. At the head of the stairs the bridegroom is received by the grand vizier; conducted by him into a room where all the ministers are assembled, and the Hatt is read aloud. This ceremony corresponds to the betrothal.

Mexican Life.—The Mexican country women, generally mixtures of very different grades of blood and nationality, differ widely from the pure



MEXICAN WOMEN.

Spanish creoles of the capital. They are not without many attractive features; their eyes are often brilliant and fiery, their hair glossy and abundant, but their noses are apt to be ugly, their mouths large, and their cheek bones too prominent. Their dress consists mostly of a light skirt of lively colors and a simple waist of white woolen.

Very little progress has been made in the method of farming in Mexico, many of the implements being crude and of a pattern in use centuries ago. As nearly all the cultiva-

tion is done by irrigation, crops are much more certain than in some districts of the United States. The plows used are wooden ones, like those used in ancient Egypt, made of a straight piece of mesquit timber a yard long, pointed at one end and wedge-shaped at the bottom. On top of this is set, at an angle of, say 25 degrees, a long pole, which, going forward, is attached to a cross bar which is tied to the horns of the oxen; on the rear end a single upright stick serves for the handles by which the peon guides his plow. With this primitive instrument the husbandman plows a gutter about three inches deep and five inches broad at the top, and his work, excepting sowing and covering, is done. When the wheat is cut and housed and stacked (and this is done in April and May) it is spread upon an adobe floor, surrounded by a wall of adobe six feet high, and upon this are turned in a number of wild horses from the range. Young boys keep them running around until the grain is trodden out, and then the mass is thrown upon another floor on a level with the top of the wall. Here

it is cast up with wooden paddles into the air, and the grain separated from the straw and chaff by the wind.

Many interesting sights meet the eye in the City of Mexico, but none are more pleasing than that of the dancing girls, who are frequently seen in the paved courtyards, which are a distinguishing feature of the hotels and public buildings. The music provided is that of a sort of fife, and the man who plays it is wonderful to behold, in his foreign finery. An immense yellow sombrero shades his face. His hair hangs in long black ringlets over his blue embroidered jacket. Under his jacket a sash of brilliant red is tied, and hangs in heavy folds almost to his feet. He has red ribbons fastened about the tight yellow stockings, and his slippers have been red. Altogether he looks as if he might have stepped out of a picture by Velasquez. But so do the maids, with their short dresses, bright aprons, sashes and head-gear, their laughing black eyes, their cheeks with the scarlet bloom, their braids of hair.

The moral condition of the lower classes is frightfully degraded. Insecurity of life and property, a chronic state of revolution, and gambling and drunkenness have caused such a degeneration of the masses, that an American writer has recently declared, that the only hope of the regeneration and civilization of Mexico, is in the absolute extinction of fully seven of her eight millions of inhabitants. Among the higher classes the prospect is hardly more pleasing. Empty formalities, the haughtiness of the old Spanish Grandees, and a show of nobility are joined to intellectual insignificance, callousness of feeling, and a pride of race simply contemptible.



DANCING GIRLS OF MEXICO.

A Country Without Women.—There is only one territory of any size, and never has been but one, occupied by any considerable population, from which woman is absolutely excluded. Yet, such a place exists to-day, and has existed for centuries. As far back as history reaches, to all females it has been forbidden ground. This bachelor's Areadia is situated on a bold plateau between the old peninsula of Aete, in the Greeian Archipelago, and the main land. Here, in the midst of cultivated fields and extensive woodlands, dwells a monastic confederation of Greek Christians, with twenty-three convents, and numbering more than seven thousand souls, and not one of the monasteries dates from a later time than the twelfth century. A few soldiers guard the borders of this anti-female land, and no woman is allowed to cross the frontier. Nor is this all; the rule is extended to every female creature, and from time immemorial no cow, mare, hen, duck or goose has been permitted to make acquaintance with this territory.

South America.—The land of the loftiest mountains, largest rivers, greatest number of volcanoes, most extensive plains, richest mines of precious metals and sublimest natural scenery on the globe is also noted for the greatest diversity in native life, composed of whites, Indians, negroes and mixed races; their habits and occupations are as varied as their shades of color and localities. In New Granada and Ecuador we find rope bridges and silleros carrying travelers in chairs on their backs; in Peru we see great cavernous silver mines; in Bolivia we view long trains of mules and llamas carrying produce over the mountains; in Buenos Ayres and Paraguay exist those vast grassy plains or pampas, a thousand miles in extent, without a tree, on which millions of horses and cattle feed, and where the Gauchos or white inhabitants live in the saddle and chase the cattle with lassos for their agreeable occupation. As we go farther south civilization recedes,



NATIVES OF SOUTH AMERICA.

until in Patagonia and Terra del Fuego it lapses into barbarism. Among the huge savages of Patagonia, who are the most gigantic men on the earth, there are some tribes who possess cannibals, while others enjoy in their peculiar life the blessings of a plurality of wives.

One of our illustrations represents a Patagonian with his wives preparing a meal, which though very frugal, will be none the less relished. During the recent war between Chili and Peru some of these tribes, considering that they owed more allegiance to Chili than to the other belligerent, offered their services, but owing to their savage mode of warfare the Chilean government declined to accept, fearing that once on the battlefield they could not be controlled.

Our next scene represents a pleasanter phase of life and pleasure; a fair fruit dealer of Rio de Janeiro surrounded by her trays and baskets of tropical fruits. And what do the other fair sisters of Buenos Ayres do? you

may ask. One glance through the latticed balconies shows well how they spend their time: lounging in their hammocks as if moulded to them, the languid and indolent *senorita* lies enjoying her siesta, or awake puffing the thin blue curling smoke from her cigarette and thinking of her conquest at the last fiesta. Even our contented looking fruit dealer finds time and means to enjoy her cigarette, as free from care apparently as the haughty dame who swings in her hammock.

Our next illustration represents primitive life on the coast of Ecuador, where even in Guayaquil, the principal harbor, one sees the curiously built bamboo houses with straw thatched roof, which abound in that sandy coun-



FRUIT DEALER OF RIO DE JANEIRO.

try. Thus we see that even yet many of the natives of South America are scarcely in advance of Africa in civilization.

Modest young men might find the mode of salutation employed by the fair *senoritas* of Peru somewhat disconcerting, though not unpleasant. The mistress of the house enters the reception-room smoking a cigarette, wearing a black silk skirt and a red or blue *sacque*, and with her magnificent hair braided down her back in two plaits that almost sweep the floor. Advancing to you she removes her cigar, spits upon the carpet, although it may be white velvet tapestry, and folds you in both arms to her matronly bosom, pushing your head gently down upon her shoulder, and patting you softly on your back. This singular proceeding answers to our handshaking. All classes meet and embrace. Young men and old women, old men and

young ladies, and even children, all unite in this parting embrace, and rarely kiss. If the daughters delay coming into the room, the mother opens the piano and plays you some national dances, sad, yet brilliant, in a plaintive minor key. Or she claps her hands, and a native brings in a bottle of wine and fruits of various kinds, and you are expected to partake, if ever so little. The daughters never keep you waiting long, if they are not at mass or shopping; and, if at home, never excuse themselves. They wear white wrappers, trimmed simply with native lace, and the heavy braids of hair like the mother's. Conversing with them, you soon ascertain the extent of their acquirements—a little French and knowledge of the geography and history

of Peru. They seldom know more than to read and write Spanish, and know nothing else, and care to know nothing else, but about Peru. They can all sing and dance, and are very charming in appearance; but you can see that they are illiterate and ignorant; that though the diamonds glisten upon small, perfectly-formed, brown hands, the hands are not only dingy, but dirty; that the nails are not clean; and that the tiny feet, peeping from the trailing white wrapper, often has either no stocking or a very dirty one, and almost always the slippers are torn and slipshod.



HOUSE ON THE COAST OF ECUADOR, SOUTH AMERICA.

A French naval surgeon has lately been exploring the northern parts of South America, more especially in the valley of the Orinoco and its affluents. Among other facts of observation, he states that the Guaraunos, at the delta of that river, take refuge in the trees when the delta is inundated. There they make a sort of dwelling with branches and clay. The women light on a small piece of floor the fire needed for cooking, and the traveler on the river by night often sees with surprise long rows of flames at a considerable height in the air. The Guaraunos dispose of their dead by hanging them in hammocks in the tops of trees. In the course of his travels, he met with earth-eating tribes. The clay, which often serves for their food whole months, seems to be a mixture of oxide of iron and some

organic substances. They have recourse to it more especially in times of scarcity; but, strange to say, there are eager gourmands for the substance, individuals in whom the depraved taste is so pronounced that they may be seen tearing pieces of ferruginous clay from huts made of it, and putting them in their mouths.

Shoshone Courtship.—Courtship among the Shoshone tribe of Indians is not so elaborate an affair as among more civilized people. In the first place it should be borne in mind that the young squaws are more fleet of foot than the bucks. Now, when a buck fancies a squaw, he provides himself with a lariat, as he would if he intended to lasso an animal. When



A PIUTE LODGE.

she sees her admirer approaching she behaves, after her fashion, in the manner of other young ladies. She runs, and the buck runs after her. If she does not wish to be caught she quickens her pace, and is soon beyond the reach of the rope; if, on the contrary, she does not object, the noose slips easily over her head, and the prize is won.

The Piute Indians of Nevada.—There are between four and five thousand Indians in Nevada, consisting of Shoshones and Piutes, the former occupying the eastern and central parts of the State, and the latter the western. The Piutes are a branch of the Shoshone tribe, and formerly both were governed by one great chief. The Piutes are not hostile to the whites, although in times past there have been fierce battles between them. the

last one taking place at Pyramid Lake. The Piutes were formerly a wild, strong, brave people, so famous as travelers that it is believed they originally came from Peru, while they now idle about the outskirts of white settlements. The name Piute was derived from their settlement near the lakes of the Sierra Nevadas, and is properly Pah-Ute or Water-Ute. In the larger towns along the eastern slope of the Sierras, the Piutes are more than half civilized, and as far as possible imitate the fashion of the white in dress, the women wearing showy cotton gowns, and the men brilliantly-colored shirts, trousers and hats. The wigwams are set a few yards apart, and resemble dilapidated circular tents. As a stranger approaches, the red proprietor comes forward to meet him with a pleasant smile and at a lazy pace, greet-



SOME PIUTE BEAUX.

ing him with the usual "How?" which is the Indian abbreviation of "How do you do?" We illustrate a lodge of the Piutes, and likewise a number of lovers sitting upon a log awaiting the arrival of their sweethearts. This is characteristic of the courtship of the Piutes.

The Sun Dance of the Sioux.—The dances of the Sioux Indians are all forms of worship, the three principal among them being the war, the medicine, and the great sun dance. When a young brave is anxious for distinction in his tribe he attempts to signalize himself in the atrocities of the great sun dance. It lasts three days, commencing at sundown, and the participants fast during the entire period. It is intended to gain the favor of the Great Spirit who dwells in the sun, and as the sun rises on the commencement of the dance, the braves salute it in chorus with their knives

bare. Long ropes of raw hide are ready, dangling from a sapling, and, as the sun comes above the horizon, each Indian seizes a rope, puts two gashes an inch deep and about the same distance apart in his back or side, runs his knife through the flesh between them, and withdrawing it passes the raw hide rope through the wound and ties it, dancing and throwing his weight on the rope for hours at a time until the flesh is torn loose and he falls exhausted to the ground. If the flesh holds too long a friend will come and give him a push. When he has fallen his comrades gather round him and say that he will be a great chief.

The Egyptians.

—The women of Egypt are not allowed to go out of doors as women in other countries are, and many of them never get beyond the walls of their houses. The cows sleep in the same hut with the people. These huts are made of mud, without windows, and the doors so small that the wonder is how the people get in. They do not wash their babies till they are a year old, because it is considered unlucky to do so. They rarely comb their hair from month to month. Their chief meal is at sunset; the rest of the time they eat at a piece of bread when they are hungry. They never use plates, or knives, or



AN EGYPTIAN WOMAN CHURNING.

forks. All sit around the table on the floor. Bread is their daily food, and each family makes for itself, as it is a kind of disgrace to buy "street bread." The women clean the corn and carry it on their heads to mill. It is made into thin, small cakes, stuck against the sides of an oven, and baked in less than a minute. A hundred loaves are not too many for a family of four in a week. Travelers are usually expected to eat three loaves apiece. They make butter in a strange way. A goatskin half filled with milk is hung on a peg, and then a woman jerks it to and fro till the butter comes. Then she drains it, but never washes or salts it. Their favorite dish is rice cooked with this butter.

In journeying from Egypt across Arabia, water is commonly conveyed in goat skins. Ox hides are often converted into sacks. A pair of these is a camel's load, and two answer for four persons as many days. The *sakkiehs* or wells used for irrigating the date-palm trees, consist of two wheels, the one set vertically to the river and slung with a chain of pots, the other a horizontal cog, turned by a camel or a buffalo.



AN EGYPTIAN WELL.

Siam.—After all that has been written about Siam and the Siamese, there remains a great deal of valuable information still to be acquired. The temples, palaces, and monuments of Siam seem to bear the impress of almost every ancient and modern civilization, Egyptian, Indian, Persian, Mongolian, and European. And yet, through all these varieties of style, they have strongly marked characteristics of their own. The government of Siam is the most singular in the world. It consists of a House of Lords, or *Senabodi*, and a *San* *Tuang*, or secret

council of twelve of the most powerful princes in the land, and a first and a second king. The second king has command of the army, and a palace and court of his own. By his high position he is exempt from the customary prostration before the first king, whom he may salute by simply raising his hands and joining them above his head. The rule of the king is absolute. He sits at the gates of the palace to receive the petitions of his people. His person is sacred. The highest, not less than the lowest of his subjects, approach him on all fours, crawling in a most abject posture. No person is allowed to stand erect in his presence. All the bridges in Siam are so constructed

that he may not pass under anything on which human feet have trod. The king is notably temperate in his diet; boiled rice and salt fish are his favorite dishes. It is curious to see him eating boiled rice with gold chop-sticks. The bowl containing rice is put on a stand a little above the level of the mouth; then the two sticks, one in each hand, stir up the rice, and with great dexterity cause it to flow in a continuous stream into the open mouth below.



APPROACHING THE KING IN SIAM.

The Abyssinians.

—The Abyssinians, in features and form, are a handsome people. They are between five and six feet in height. Erect and slender, they are not devoid of muscular strength, nor of that symmetrical roundness which so much contributes to the beauty of the human frame. The costume of the Abyssinian is exceedingly simple. Men of all ranks, from the king to the beggar, wear a shama, or loose dress of white cotton, which, in graceful folds, is thrown over the shoulders so as to leave the

hands and arms free to carry spear and buckler. The softness of the web, and the depth of the red border round the bottom of this convenient garb, indicates the social position of the wearer, and this is so minutely defined, that any one who should presume to ape his betters would, in all probability, obtain a lesson or two on dress from the imperial giraffe-holder. Beneath the shama the aristocrat dons his silken, damask, or velvet kamees; but this is a privilege only granted to a few magnates, and those whom the king delights to honor. Trousers of the same material as the shama are worn by all, and



EATING RICE IN SIAM.

also the cotton waistcloth, which is so long that when wound round the waist, it serves the purpose of armor, in warding off blows, or in protecting from the thrust of sword or lance. When engaged in battle, the shama is



THE ABYSSINIANS.

exchanged for the dino—a mere piece of skin, sometimes of the lion or leopard, but more commonly of the sheep.

The Herdsman of the Alps.—The herdsman of the Alps leads a life peculiar to his race and land. The pastures whereon his cattle graze have no resemblance to the broad prairies of our own land, or to the almost boundless pampas and sheep-walks of South America and Australia. He has no use for horses or weapons of defence; formidable beasts of prey have long since disappeared before the prowess of the hardy Alpine hunter, and the narrow valleys, precipitous mountain paths, and elevated plateaus hemmed by almost unfathomable gorges, afford too precarious a footing for the horse. During the summer the mountains yield plentiful pasturage, but in spring it does not come at the same time on all the pasture lands. The grass on the lower valleys and slopes starts first; then the herdsman leads out his cattle, as the accompanying illustration shows, and they cross the streams by means of rude bridges, sniffing, with keen enjoyment, the mountain air from the summits of rocks, and reposing at ease when their appetites are satisfied on the luxuriant grass. As the summer advances the higher pastures are approached, and in July and August the herd feeds on slopes that are just below the eternal snows. Autumn comes and the herdsman turns homeward, and when the winter storms are reveling above, the cattle are grazing again in the lower valleys. The herdsman loves his mountain life as the sailor loves the sea. Setting forth in the spring, he carries on his broad shoulders his household furniture, holding in one hand the milk pail, and grasping in the other the iron-pointed alpenstock. A large basket on his back contains his milk strainer, some straw, a milking stool, a cheese mold, the stand on which the cheeses are placed to drain, and the kettle in which the curd is made. Seldom, until winter, can he revisit the *chalet* where his family lives,



THE HERDSMAN OF THE ALPS.

and as he ascends the rugged mountain path he casts an affectionate, lingering glance below.

Life in Iceland.—Men and women, masters and servants, all inhabit the same room, while cleanliness is not much attended to; but, poor as they are, and accustomed to great privations, they set an example of cheerful contentment. The beauty of the young girls is remarkable; their fair hair falls in long plaits, partially covered by a black cloth coil, daintily worn on one side of the head, finished at the top with a tassel of colored silk, run through a silver or steel buckle, which floats on the shoulder. It reminds the traveler of the Greek head dress, but the blue eyes, with their sweet, benevolent expression, soon recall to their minds their Danish origin. The dress is made of the cloth woven in the country, and on festive days the bodice is gaily adorned with silver braid and velvet, while the belt and sleeves are ornamented with silver devices, beautifully chased, and often of

great value. On wet and cold days the shawl becomes a useful mantilla, completely enveloping the head, and defending the wearer from the effects of the frequent storms.



AN ICELANDIC LADY.

The Lapp and His Reindeer.—The mountain Lapps of Norway have learned to drink coffee and wear stout Norwegian cloth, but they set as much store by the reindeer as ever. A poor family will have fifty and upward in a flock, the middle classes 300 to 700, and the richest 1,000 or more. The reindeer is as much beloved by the Lapp as his pig by the Irishman,

and the reindeer often sleep in his hut in much the same fashion. The Lapp will whisper to his reindeer when harnessing him to his sleigh, and will tell him where he is to go, and declares he understands him. The reindeer is much like a stag, only smaller; all the people, animals and trees in Lapland are very diminutive, the men are mostly under five feet high, and the women under four feet nine inches, so great are the rigors of the climate in this as in all countries under the Arctic Circle; and the cows, sheep and goats are small in proportion. In summer the reindeer feed upon grass, and give excellent milk; in the winter they feed upon moss, which they scratch up under great depths of snow with marvelous instinct. When winter draws near great numbers are killed, and the flesh is dried and smoked to provide food when the ground is covered with snow, and but few birds, like ptarmigan, partridges and capereailzie, are met with. The flesh is very nutritious, and after a course of grass feeding it is surprising how soon the reindeer become fat and plump. The skin makes their dresses and boots, the sinews their thread and fishing lines, and the horns their domestic utensils.

Mountain Traveling in Spain.—To all lovers of natural scenery there is a peculiar charm in mountain traveling. It offers a wonderful variety of experiences, and though often fatiguing, is not wearisome because of monotony. The modes differ, it is true. In these latter years facilities of all kinds are rapidly multiplied. Locomotion upon mule back was form-



MOUNTAIN TRAVELING IN SPAIN.

erly the sole means in mountain regions, as it remains to this day in many countries. Our engraving spiritedly illustrates some of its felicities in Spain, where the spirit of Progress is as yet only manifest in political strivings after Republicanism. These narrow paths, winding around giddy ledges, where a misstep would send you a thousand feet below, are pleas-

anter in the picture than in reality. And the lolling in *dolce far niente* style upon your mule's back, guitar in hand, idly strumming its strings while your deft-footed animal picks his way along, is rather more sentimental and less practical than even things Spanish are ordinarily apt to be.

A Dinner in Palestine.—The Jews generally eat their dinner before noon, and their supper after sundown. The chief meal of the Jews was in the evening; of the Egyptians it was at noon. The early Hebrews sat or squatted round a low table upon which the meal was served, but in later times couches were used to recline upon before the tables. The guests were ranged in order of rank side by side, resting upon the left elbow, the right arm being free. The dishes, as they are to this day, were generally stews of rice, beans, and bural (cracked wheat), with soups or sauces. The meats were so cooked that when served they fell to pieces. Knives



A DINNER IN PALESTINE.

and forks were not used at the tables, but spoons, and generally thin slices of bread, were doubled up and dipped into the dishes, all eating from the same dish. These pieces of bread also served the purpose of napkins.

Bagdad Customs.—

Among the more wealthy, the husband sleeps on a raised bedstead made of wicker work called *doeshick*. It has a mattress and cushions of silk or cotton, and is covered by a thick quilt, but is without curtain or mosquito-net. The night-air is always dry; toward morning there usually springs up a cool breeze that dies away soon after sunrise. The wife occupies a similar bed, but always on the

ground—that is, without a bedstead, and always at a respectable distance from her husband. The children are scattered about on mattresses, and the slaves or servants sleep on mats, but all within sight of each other. In a few houses there are low parapets dividing off the sleeping apartments, but these are rare, and probably occupied by Europeans. In retiring, the natives do not divest themselves of the clothing worn during the day except to lay aside the outer robes. After rising, the husband performs his devotions, and then seats himself on his carpet, where his wife serves him with a chibouk and coffee with her own hands, retiring at a respectable distance to wait for the cup, and sometimes with hands crossed, and even kissing his hand on receiving the cup from it—a mark of respect very common in the East. While the husband is lounging on the carpet or cushions, enjoying his morning pipe, the women of the family generally pray, going through the same forms and prostrations as the men; but the children under twelve years of age never join in their devotions,

How they Dance in Italy.—In Italy, where the country men and women dance together, the first thing they do is to toss off their shoes, if they wear any. A man don't go up to a woman and ask her if she will dance, but he fixes his eye on her from a distance and nods. She nods in return, and then both kick off their shoes and advance towards each other and begin to dance. The dance, besides an incessant up and down of steps, represents also quite a little love drama in gestures, and the success of the dance depends on the cleverness of the dancers to express the mimic scene. He courts, pleads, beseeches, runs after his dancer, tries to clasp her waist and kiss her; all the time he is dancing. The girl, of course, denies, laughs, shakes her head and escapes her partner, till at last, the dance finished, she rushes to her place and resumes her shoes.

The Greeks.—The Greeks belong to the great Indo-European race, who from the earliest times have been the conquerors and civilizers of the world. They are the only existing representatives of the ancient world. They have maintained possession of their country, their language, and their social organization, against physical and moral forces which have swept from the face of the earth all their early contemporaries, friends and enemies. Even in dress they retain the steeple hat and tassel at the end, also the gay vest and baggy trousers.



THE GREEK.

A Wedding Race.—

Among the Huzarehs—a people of Asia—the following is the way weddings are managed: The suitors of the maiden, nine in number, appear in the field, all unarmed, but mounted on the best horses they can procure; while the bride herself, on a beautiful Tureoman horse, surrounded by her relations, anxiously surveys the group of lovers. The conditions of the bridal race are these: The maiden has a certain start given, which she avails herself of to gain a sufficient distance from the crowd to enable her to manage her steed with freedom, so as to assist in his pursuit the suitor whom she prefers. On a signal from the father, all the horsemen gallop after the fair one, and whichever first succeeds in encircling her waist with his arms, no matter whether disagreeable or to her choice, is entitled to claim her as his wife. After the usual delays incident upon such interesting occasions, the maiden quits the circle of her relations, and, putting her steed in a hard gallop, darts into the open plain. When satisfied with her position, she turns round to the impatient youths and stretches out her arms towards them, as if to woo their approach. This is the moment for giving the signal to commence the chase, and each of the impatient youths, dashing his pointed heels into his courser's sides, darts like the unhooded hawk in pursuit of the fugitive dove.

The race-course is generally extensive—say twelve miles long and three in width—and as the horsemen speed across the plain, the favored lover becomes soon apparent by the efforts of the maiden to avoid all others who might approach her.

Weddings in Borneo.—On the wedding-day the bride and bridegroom are brought from opposite ends of the village to the spot where the ceremony is to be performed. They are made to sit on two bars of iron,



MARRIAGE CEREMONY IN BORNEO.

that blessings as lasting and health as vigorous may attend the pair. A cigar and betel-leaf, prepared with the areca-nut, are next put into the hands of the bride and bridegroom. One of the priests then waves two fowls over the heads of the couple, and in a long address to the Supreme Being calls down blessings upon the pair, and implores that peace and happiness may attend the union. After the heads of the affianced have been knocked against each other three or four times, the bridegroom puts the prepared siri-leaf and cigar into the mouth of the bride, while she does the same to him, whom she thus acknowledges as her husband.

Salutations.—Arabs of distinction kiss each other's cheeks and their own hands, and exclaim, "God grant thee his favor and send thy family health." Women and children kiss the beards of their husbands and fathers.

Burmese rub their noses on each other's cheeks and say, "Give me a smell!"

Chinese ask of equals, "Have you eaten your rice?" "Is your stomach in order?" The response is, "Thanks to your abundant felicity."

In some parts of Germany, gentlemen invariably kiss the hands of their lady acquaintances when they meet, and gentlemen kiss each other on the cheek.

Hollanders, with their proverbial love of good living, salute their friends by asking, "Have you had a good dinner?"

Italians kiss the hands of ladies to whom they are related, asking, "How does she stand?"

Japanese remove their sandals when they meet a superior, exclaiming, "Hurt me not!"

Laplanders, when they meet on the ice, press their noses firmly together.

Mohammedans say, "Peace be with you;" to which the reply is, "On you be peace;" to which is added, "and the mercy and blessings of God."

Manillas bend their bodies, place their hands upon their cheeks, raise one leg, and bend the knee.

Moors ride at full speed toward a stranger, suddenly stop, and then fire a pistol over his head.

Persians salute by crossing necks, and laying cheek to cheek, with the extravagant greeting, "Is thy exalted high condition good?" and "May thy shadow never be less."

The negro kings on the African coasts salute each other by snapping the middle finger three times.

In Otaheite they rub noses, a custom common with many savages.

The inhabitants of Carmine, when they show particular attachment, open a vein and present their blood to their friend to drink.

Philippine Islanders take a person's hand or foot and rub it over their faces.

In the Straits of the Sound they raise the left foot of the person addressed, and pass it over the right leg and then to the face.

The usual words of salutation in Cairo are, "How do you sweat?" an absence of perspiration being, in that climate, an indication of fever.

Customs of the Russians.—Russian courting, among the middle classes, is peculiar. The first Whitsunday after a young girl is acknowledged by her mother to be of marriageable years, she is taken to the Petersburg summer garden to join in the "bridal promenade." This consists of the daughters of the Russian tradesmen walking in procession, followed by their parents. Up and down they go, pretending to chat with each other and to take no notice of the young men—the tradesmen's sons, dressed in their best clothes—who walk in another procession on the other side. However, every now and then some young fellow slips out of his proper rank and adds himself to the line of girls on the other side, speaking to one particularly. The parents of the girl join in the conversation in a few moments, and soon they leave the promenade and are joined by the parents of the young man. Generally the old folks have talked it over before, but on this occasion every one pretends to be surprised. On the next day a female confidante calls on the girl's parents and asks her hand. This granted, all the relations

on both sides meet and argue about the portion to be given with the girl. If this is not satisfactory all is at an end; if it is what is expected the betrothal takes place. The bride and bridegroom kneel down upon a great fur mat, and the bride takes a ring from her finger and gives it to the bridegroom, who returns the gift by another. The bride's mother meanwhile crumbles a piece of bread over her daughter's head, and her father holds the image of his daughter's patron saint over his future son-in-law's well-brushed locks. As they arise the bridesmaids sing a wedding song. The guests each bring forward a present of some sort. Wine is handed about, and some one says it is bitter and needs sweetening. Upon this the bridegroom kisses the bride—the sweetness being supposed to be provided by this kiss—salutes the company and takes his leave. Courting time has now begun. Every evening the lover comes to his lady's home with a present, which is always something good to eat—generally cakes or sugar plums. He makes love under rather awkward circumstances, for the bridesmaids sit about the betrothed pair in a circle, singing songs descriptive of their happiness. The last evening of the courtship is enlivened by the presentation of the gifts of the bridegroom, which must include brushes, combs, soap and perfumery. On receiving these, the bridesmaids instantly carry the bride away and wash her, dress her hair and perfume her pocket handkerchief. Thus touched up she returns to the company, and the bride's father gives his future son-in-law the marriage portion, which he takes home with him in a neat bag. The next morning he returns for the lady herself. She receives him with her hair unbraided and flowing down her back. They are married by the ceremonies of the Greek Church, and the old folks never go to the wedding dinner. Those eternal bridesmaids, whom they must hate by this time, are there, however, still on duty, and the evening closes by the bride kneeling down and pulling off her husband's boots, to prove her intention to be an obedient and submissive wife.

The chief peasant in a Russian village sometimes has more power than any man in the empire excepting the Czar. He has the power, for instance, of ordering a culprit to be flogged—a right which is denied by law to any other public functionary or citizen in the empire. Further, a majority of the peasants in a commune can sentence one of their number to be beaten with sticks, and there is no appeal against the sentence. It is true that women may no longer be flogged, and that the maximum number of blows which may be inflicted on a man is twenty, while formerly men were sometimes beaten to death by order of the commune; but the commune can still sentence a man to banishment to Siberia for life. This sentence has been passed for such petty offences as stealing a handkerchief or a little honey, or opening a brandy-shop without the permission of the commune.

When a merchant gives a dinner, says the author of "Russia and the Russians," he and his wife stand behind the chairs of the guests, and wait upon them, receiving the dishes from the servants and placing them upon the table. Every time one of the guests asks for more sweetening in his wine, the merchant must march round the table, meet his wife, and salute her. When it is a newly-married couple this ceremony, from the frequency of its being required, often becomes fatiguing to the parties.

Courting in Burmah.—Courting in Burmah is all done at night. There is, in fact, a special time for it, designated in popular chronology as "lads-go-courting-time." This is a kind of indefinite period, centering round nine o'clock in the evening. Though the smitten youth may not

philander to his Duleinea alone, he is spared the presence of the old people. It is not etiquette for them to be present. Nevertheless, though this is perfectly recognized, it is not always agreeable or convenient for the parents to get out of the way whenever the gallant wants to do some sweethearting.

Burmese houses are all on piles, and never more than one story high. As a general rule, there are only two or three rooms altogether, and there are, therefore, but two courses open to the elders. They must either go out and wander about while the courting goes on, or they must go to bed. The former alternative does not commend itself to the mother, who likes to superintend operations for herself through a convenient slit in the bamboo walls, and going off to bed, as it were, at word of command is only compatible with a most mild and yielding disposition in the father. Consequently, when the girl is arrayed for conquest—flowers twined in her hair, fragrant cosmetics on her cheek and neck, and her finger nails delicately tinted—it is not always possible to summon the ardent youth forthwith. He is outside, dressed in his smartest, and with a couple of companions bent possibly on the same errand as himself; but he is obliged to stay there till he gets the signal that the coast is clear, and that he may come up.

Every youth has his own private signal, by means of which he announces to his lady love his arrival in the street. This is almost invariably effected by means of a fiddle with two strings. The tone of the instrument is not sweet, and the performer starts by the light of nature. He saws backward and forward diligently, and keeps a vigilant look-out for the wave of the handkerchief or the jerk of the lamp which will announce to him that the coast is clear, and that he may advance and pay his devotions. Natural feelings, as well as a sense of sheepishness, prevent him from executing his notes immediately in front of the house. He therefore stations himself at the nearest corner, or a hundred yards or so down the street. The result of this is that he has to fiddle away all the harder, and therefore to extend the infliction over the greatest possible area of the quarter.

When at last the happy man receives his summons, there is peace again for a time, only, however, to be interrupted in something less than an hour, when, the sweet nothings having all been said as best they can be before an unsympathetic audience, the young men issue forth to go to some other girl's house, where another of the party is interested. And so it goes on until it is too late to make further rounds, and a relieved neighborhood sighs with delight to find that it is "lads-go-home-time," otherwise "men's-foot-silent-time," and that there will be no more fiddle-scraping for another twenty-four hours.

Sandwich Island Houses.—The houses of Honolulu are always open, day and night, as the temperature is so warm that one has to sleep out of doors. They are built mostly of wood, though many of the oldest and more substantial houses are built of coral stone, a few of lava stone, and many may yet be seen within the limits of Honolulu made of grass and occupied by the natives.

These native huts or houses are built by making a framework of bamboo poles, covered with layers of the banana tree, the trunk of which can be removed in layers. This, again, is covered with grass and trimmed on the corners and top by weaving the grass into different patterns. One opening or door usually admits enough light and air for the average native, though some huts are divided off into several rooms, with two and sometimes three doors.

A mat hung down on the inside, covering the opening, is the common door. Mats made of broad grass interwoven or braided, and sometimes flags, form the carpets, and a pile of from two to ten, and sometimes even more, makes the bed on which the natives and invited guests sleep.

Furniture there is none, the natives always sitting on the ground with their legs crossed beneath them. Their kitchen is outside, and is composed of a heap of stones, and ordinarily an iron pot.

Habits of Siberians.—Many of the habits and customs of these people are very singular. Along with much rudeness and simplicity, they have a high degree of ingenuity. At night, for instance, an Ostiak can tell the time very accurately by judging the position of the Great Bear; and as this constellation is constantly varying with the season, the operation involves on the part of the Ostiak a calculation of some magnitude. In common with all barbarous and semi-barbaric races, they manifest great dexterity in the use of weapons. In shooting small animals, such as squirrels, hares, etc., for the sake of their furs, care is taken that the animal shall be struck on the head only; and in this the native seldom fails, even though their rifles are very clumsy in construction. With the bow and arrow, which is the weapon most in use, they are equally dexterous. Their method of catching salmon, as described by a Cossack officer who witnessed it, is peculiar. In marching through the country at the head of a detachment, he encamped one evening on the banks of a river; and on the following morning he observed one of the natives walk to a pool near at hand, into which he waded, and then stood motionless as a statue, his spear poised aloft, and his keen eye fixed on the water before him. Not a movement indicated that life inhabited the figure, until, with lightning rapidity, the spear was launched forward and as quickly withdrawn, a fine salmon quivering on its barbed point. Three times in twenty minutes was the operation performed, and each time a fish rewarded the native's skill. And yet their cleverness is but slightly applied to the arts of life. The Tunguses, for instance, use bear and reindeer skins to form their beds; but as they have never discovered the art of tanning, these articles when not in use are buried beneath the snow, by which means the hair is prevented from falling off. This same tribe, too, are remarkably improvident; they will consume nearly a week's provisions in one night, and go hungry the remaining six days.

An Afghan Beauty.—The Afghan beauty has blue-black hair, plastered stiff with gums, and either worn in various forms on the head or plaited in long braids down the back. The margins of the ears are pierced and decorated with rows of small silver rings, while large rings hang from the lobes. The neck and breast are tattooed with little figures of stars and flowers, and the sparkle of the lustrous black eyes is enhanced by coating the lids with black antimony. The cheeks are roughed and dotted with little round moles of gold and silver tinsel fastened on with gum. A loose muslin or silk jacket of yellow, blue or red, hangs below the waist, and wide trousers of silk or other colored material complete the indoor costume. On going out, the lady wears leggings of cotton cloth, gartered at the knee, shoes of red or yellow leather, and a hookaposh or cloak. Some ladies wear horse-hair veils, and others fasten vinaigrettes to their foreheads which contain attar of roses or other scents. Afghan ladies exercise much influence over their semi-savage husbands, and one of Shere Ali's wives sometimes smartly boxes him on the ear with a slipper.

A Persian Wedding.—From an early hour in the morning of a Persian wedding—I speak of a wedding in the middle ranks of life—there has been considerable bustle in the house of the bride's father. Carpets have been borrowed, and rooms that at other times were unused and empty are now furnished and decorated with flowers. The poor are standing in a crowd at the outer door, sure of being plentifully regaled. The outer court has been got ready for the men. Vases of flowers are placed in rows at all open windows and in every recess; thirty or forty pounds of tobacco have been prepared by pounding and moistening for smoking; the courtyard is freshly watered. If it be a calm day—and spring and summer days in Persia are always free from wind—rose-leaves are sprinkled on the surface of the water of the tank in the center of the courtyards, so as to form the word *Bismillah*, the pious welcome of the Mussulman. Similar preparations, but on a larger scale, have been made in the handsome courtyard which contains the women's quarters. From this courtyard the negresses may be seen busily engaged in the kitchen preparing the breakfast for perhaps one hundred guests, and the visitors will stop all day, only leaving to escort the bride to the home of her new husband, whither she will go after dark.

Large samovars, or Russian urns, which are in use in every Persian house, are hissing like small steam engines, ready to furnish tea for the guests on their arrival; not our idea of tea, but a pale infusion, sweetened to the consistency of syrup, from the center of each cup of which will project a little island of superfluous sugar. Orange, sherbet, lemon, pomegranate, rose-water, cherry, quince, and an endless further variety of these refreshing drinks will be offered the thirsty guests. And now come the musicians—the Mussulmans and the Jews—the latter a ragged and motley crew, but more skillful than their better-clad rivals.

At last all is ready. The master of the house, dressed in his best, gives an anxious glance at the preparations, and has an excited discussion with his wife or wives. He waves his hand to the musicians, and hurries to a seat near the door to be ready to welcome his guests. The music strikes up a merry tune. Then in a loud scream rises the voice of the principal solo singer, who commences one of the sad love-songs of Persia in a high falsetto voice. His face reddens with his exertions, which last through a dozen verses. His eyes nearly start from his head, the muscles of his neck stand out like ropes, but he keeps correct time on the big tambourine, which he plays with consummate skill.

The music is the signal to the invited guests; they now arrive in crowds. The host receives them with transports of pleasure—all the extravagant compliments of Eastern politeness pass between them. "May your wedding be fortunate!" "You are indeed welcome; this is a never-to-be-forgotten honor to me, your slave." In they pour, the men in their best; the women, closely veiled, pass on unnoticed by the men into the bride's rooms, where they unveil and appear to the delighted hostesses in their finest clothes and all their jewelry, and in most cases with their faces carefully painted. All the dresses worn among Persian ladies for indoor use only reach to the knee; their wearers look like opera dancers. The ladies' feet and legs are bare, as a rule, and a gauze shirt of gay color and a tiny zouave jacket, elaborately embroidered, are worn. The colors of their clothes are of the brightest, and the quantity of solid jewelry worn in honor of the bride is prodigious.

Conversation goes on, pipes are smoked by both men and women. Messages pass between the two courtyards. But the men remain in their quar-

ters and the women in theirs. The musicians and buffoons, however, are allowed in the women's court on these occasions; they are supposed to be mere professional persons, and on this account are tolerated. At noon a heavy breakfast is served, after which buffoons dance and sing songs indecent enough in themselves, but tolerated in the East on such occasions.

The bride meanwhile goes to the bath, whither she is accompanied by many of the ladies, the friends and near relatives of the family, who superintend her toilet and perfume her body. At twilight there is a hum of suspense. The whole place is lighted up by lamps, candles in shades and lanterns. A noise of a distant crowd is heard; alms in money are freely distributed among the crowd of beggars and poor at the door; horses are brought for the bride and her friends. The procession of the bridegroom is approaching, and it must be understood that another grand party has been going on at his father's house; the musicians sing and play their loudest; the roofs (the flat roofs of the East) are thronged by all the women and children of the quarter. The bride appears, carefully veiled. She goes to the door and mounts a gayly caparisoned horse. All the male guests join the procession. Lighted cressets, full of blazing embers, are carried on high poles to lead and light the way. The lanterns of all the guests are lighted and carried in this procession, which joyfully wends its way through a cheering crowd. At the moment the bride leaves her father's house a shout of "Kel lel lel!" announces the fact. Fireworks blaze, the music is deafening; above all is heard the monotonous banging of the wedding drum. And so, the buffoons and musicians leading the way, the procession slowly moves on. As it approaches the house of the bridegroom, several sheep are sacrificed in honor of the bride; they are slain at her feet as she steps over her husband's threshold for the first time, accompanied by a female friend or two. Then, invoking blessings on the pair, all wend their way home, and the festival is over.

A Persian Dinner.—A traveler thus describes a dinner in Persia: "A tray, containing a chillo and pillo, radishes, fried eggs, a stew of meat, and a bowl of sherbet, was allotted to each two persons, and, at the word 'Bismillah' (in the name of God), the company fell to in silence, unbroken during the whole time, save by the sound of the various jaws in process of mastication. Hands were thrust deep into the greasy dishes, rice squeezed into balls and swallowed with astonishing rapidity; and in less than a quarter of an hour little remained of the immense piles which had been set before them. Water was then brought in, and each guest slightly wetted his fingers, afterward wiping them on his pocket-handkerchief or coat, as the case might be, which ceremony had scarcely been performed when our Shah-seven friend and one or two others loosened their belts, and immediately lapsed into a state of torpidity."

A Death in Persia.—The sick man lies *in extremis* on a thin mattress upon the floor, covered by a quilted silken coverlet. Twenty or thirty persons are in the room where he is dying. The smoke of many hubble-bubbles clouds the air; whispered conversation is general. The doctors have declared their patient's condition hopeless, and as a last resort, certain charms suggested by a weird-looking dervish have been tried. But the crab broth, prepared from the tiny crustaceans that inhabit the streamlets round Shiraz, the patient has been unable to swallow; and the dervish hints out to the relatives of the dying man that his panacea has only not

proved infallible because it was tried too late. A veiled woman, the wife of the dying man, sits weeping at the side of her husband's pillow. She frequently holds to his face a moistened piece of mud torn from the wall (this wetted mud is supposed to have a very reviving influence, and is used by Persians as we use smelling salts).

Tea is handed round in small cups; the crowd in the room becomes greater; every window is shut, and, as the outside temperature is ninety degrees, some idea of the heat within can be formed. The crowd is not here from mere curiosity. A man is sick; then where should his friends be, they say, if not by his bedside? The samovars (Russian tea urns) steam and bubble; the room is filled with clouds of tobacco smoke and the steam from the urns. And now, just as two hundred years ago was done in England, a fowl is killed and placed warm and bleeding on the patient's feet. All is of no avail, however. The man has breathed his last.

The wife yields her place by the bedside. Moistened cotton wool is placed in the mouth of the dead, in the orifices of the nostrils, and in the ears. A moollah begins to read aloud the prescribed portion of the Koran, commencing, "O man, I swear by the instructive Koran that thou art one of the messengers of God sent to show the right way," etc. This portion of the Mussulman's sacred book was called by Mohammed himself "the heart of the Koran." And now all present witness aloud that the dead man was a good and pious Mohammedan. The limbs are composed, and a cup of water is placed at the head of the corpse. No sooner is this done than a moollah ascends to the flat roof of the house and begins to read in a shrill monotone certain verses from the holy book. This announces to the neighbors that the man is veritably dead; and at the same moment his relations shriek and wail, "Woe, woe! he is dead; he has passed away." These are the expressions of a real grief. But presently the professional mourners arrive and rend the air with their shrill screaming, which is like the "keening" of the Irish.

The house is soon filled with friends and neighbors, who add their cries to the screams of the mourners. The women of the family hasten to array themselves in "bitter" (*i. e.*, sombre) garments—not in actual black, but in sad colors; neither they nor the men wash or dress their hair until the funeral and the first days of mourning are over. The male relatives do not literally rend their garments, but give them the right appearance by opening certain seams of their coats and cloaks with a penknife; and instead of casting dust upon their heads they dab mud on their hats.

And now come the "washers of the dead." To each parish are attached a family of these people, who get a despised livelihood by performing the last offices for the dead. The corpse having been washed at an adjoining stream, the hands are placed across the chest, and it is wrapped in the shroud of cotton cloth that the deceased has probably had by him, as a sort of *memento mori*, for years. Camphor (real vegetable camphor) is placed beneath the shroud, and the body is laid in a rough coffin made of thin planks and brought back to the house. The coffin in Persia is of a thin and unsubstantial kind, and the burial always takes place within twenty-four hours of decease.

Moslem Marriages.—Brokers generally arrange these marriages, though there are some love matches in which the parties become attached to each other without the intervention of a third party. When a man has reached the marrying age, he is expected to enter the matrimonial ranks,

unless prevented by poverty or some other impediment, and it is considered improper and even dishonorable for him to refrain from so doing. If a marriageable youth has a mother, she describes to him the girls of her acquaintance, and enables him to decide whom to take to his house and home. Frequently he engages the services of a woman marriage broker, who has access to harems where there are marriageable women, and is employed by them quite as often as by the men. She receives fees from one party, and frequently from both. In her visits to the harems she is accompanied by the mother or other feminine relatives of the young man; she introduces them as ordinary visitors, but gives a sly hint as to the object of their call. If they do not like the appearance of the maiden, they plead many calls to make, and cut short their stay; but if satisfied, they come to business at once, and ask how much property, personal or otherwise, the young lady possesses. When these facts are ascertained, they depart, with the intimation that they may call again. If the young man is satisfied with the report of the broker, he sends her again to the harem to state his own prospects in life, and if she looks favorably on his suit, the match is made. Everything is arranged by deputy, and the Mohammedan lover does not see the face of his mistress until she is his wife.

Marriages in Servia.—The fathers of two houses concerned meet and settle the matter together, exchanging presents which often amount to a considerable value. The brother of the bride delivers her to the solemn procession, which comes to conduct her to her new abode; and there she is received by the *sestee*, a sister-in-law of the intended bridegroom. She dresses a child, touches with a distaff the walls, which are so often to see her occupied with this implement, and carries bread, wine and water up to the table, which it will become her daily duty to prepare. With these symbolical ceremonies she enters into the new community. Her mouth is sealed by a piece of sugar, to denote that she should only utter little, and only what is good. As yet she is only a stranger, and for a whole year she is termed the “betrothed.” By an assumption of continued bashfulness, prescribed by custom, she keeps apart even from her husband. In the presence of others she scarcely converses with him, much less would a playful phrase be permitted from her lips. It is only when years have past, and she has become the mother of grown-up children, that she, in reality, finds herself on an equality with the other members of the household.

Marriage Customs in Tartary.—Among the Kirghese the practice of polygamy obtains. Generally the eldest brother of a family has more than one wife. The first wife is mistress of the household, and is called *baibiche*. To her are subject not only her husband's other wives, but also all the other females of the family. The head of a household will often send a portion of his herds several hundred miles away under the care of his wife, while he himself will either remain with his other wives about the grazing ground, or go and encamp somewhere by himself. In winter the family comes together again. The manifold circumstances connected with marriage among the Kirghese are somewhat formidable, and involve the payment of a *kalim* beside the giving of various presents. The affair is arranged as to its preliminaries by matchmakers, and the bridegroom after betrothal has sometimes to wait for a year or more until he can bring the remaining portion of the *kalim*. If during this period the betrothed girl should die, her parents are bound to give instead their next daughter, or in

default to return the kalim and pay also a fine of one or two horses and robes or furs. So also is it if the girl should refuse to marry, which she may do on account of the suitor's ill health, or his poverty, or (in some localities) her personal dislike. Yet another custom is that if the bridegroom die or refuse to marry the girl his parents are bound to take her for their next son, paying a fine, usually a camel, in ease of refusal. When the prescribed period of betrothal is at an end, the bridegroom dressed and mounted at his best, goes with his friends to the aul or village of the bride, where the tent has been prepared for his reception. Throughout the ceremonies of betrothal the bride's brother has the right of pilfering from the bridegroom whatever he pleases; but now the bride's relations come and take as presents almost everything he has—his coat, hat, girdle, horse and saddle, saying each one that they are for the education of the bride—a seizure that is afterward repaid by the relations of the bridegroom on the visit to their aul of the relations of the bride.

Polygamy in Kafirland.—Polygamy is universally admitted throughout all Kaffraria, nor is there any legal limit to the number of wives. But in Kafirland a man is not entitled to choose his wife or wives; his wishes are in a great degree subordinate to the "intentions" of those who have daughters to settle in life. The number of wives, therefore, is generally proportioned to the wealth of the husband. The refusal of a bride is considered an insult to the family, to be expiated only by the plunder of the offender's kraal, or by his blood. An old man, if wealthy, is therefore sure to be burdened with a "large establishment;" and he is frequently obliged to accept a young wife when his feelings would rather lead him to decline the proffered happiness. The average number of wives to each married man among the common people is said to be about three, but the old Kafir lawyers, who have amassed wealth in the pursuit of a lucrative profession, are known to have as many as ten forced on them, and these ladies are not long in learning the art of dissipating a fortune, or of bringing their niggardly lord to his grave. A Kafir, moreover, is obliged to take not only any wife that may be offered to him, but to pay for her, although the transaction is not regarded in the light of a purchase. The original idea was, that the "consideration" should be held as a deposit or security for the proper treatment of the women, and as a token of her husband's regard; and, accordingly, a girl considers herself as slighted if the usual *honorarium* has not been given to her parent. A young bride has been known to run away from her husband when she discovered that she had not been paid for.

Australian Marriage Customs.—When a girl is betrothed her mother and aunts may not look at or speak to the man for the rest of his life, but if they meet him they squat down by the wayside and cover up their heads, and when he and they are obliged to speak in one another's presence they use a peculiar lingo which they call "turn-tongue." This queer dialect is not used for concealment, for everybody understands it, and some examples of it show that it has much in common with the ordinary language. To give an idea of the state of formality into which life has come among these supposed free-and-easy savages, mention may be made of the duties of the bridesmaid and groomsman. When the married pair have been taken to the new hut built for them, for the next two moons the groomsman and the husband sleep on one side of the fire, the bridesmaid

and the wife on the other, the new married couple not being allowed to speak to or look at one another. The bride is called a "not-look-around," and the pair in this embarrassing position are a standing joke to the young people living near, who amuse themselves by peeping in and laughing at them.

A Bulgarian Wake.—When the father of the family feels his end approaching, he sends for the priest and begins to bargain with him about his funeral, and settles the details of his "wake." Having arranged all this and his other worldly affairs, he feels comfortably prepared to leave the world, and when his agony commences, to have a lighted taper placed in his hand, his jaws bound up with a cloth, and his eyelids closed. The moment his pulse has stopped, all the pots, pans, jars, kettles, etc., in the house are turned upside down to prevent his soul from taking refuge in one of them, and great care is taken to prevent either man or animal—especially a cat or dog—from stepping across his body, as otherwise he would turn into a vampire, and be a continual nuisance and a danger to his family and the whole community. Within a few hours of death the body is buried, without any coffin, in a shallow grave, eighteen to twenty-four inches deep, and left there for three years, during which time many offerings of food and wine are placed upon it. At the end of the third year the bones of the dead man are dug up, carefully washed, put into a linen bag, laid before the episcopal throne, of which there is one in every village, blessed by the pope, and then finally buried for good. Thus the Bulgarian is well taken care of after his death, unless, indeed, there is any reason to believe that he has become a vampire. In that case the grave is opened and the body transfixed by a stake, or a nail is driven into his breast. If the body is very well preserved, then it is riddled with pistol shots, and the earth stamped down firmly upon it, or sometimes it is burnt to ashes by a fire made of thorn.

Mourning Customs.—The ancients had queer ideas about mourning for dead. The Egyptian women ran through the streets crying, with their bosoms exposed and their hair disordered. The Lycians regarded mourning as unmanly, and compelled men who went into mourning to put on female garments. In Greece, when a popular general died, the whole army cut off their hair and the manes of their horses. At the present day, the Arabian women stain their hands and feet with indigo, which they suffer to remain eight days. They also carefully abstain from milk during this time, on the ground that its white color does not accord with the gloom of their minds. In China, the mourning color is white. Mourning for a parent or husband is required there by law, under penalty of sixty blows and a year's banishment. When an emperor dies, all his subjects let their hair grow for one hundred days. In the Feejee Islands, on the tenth day of mourning, the women scourge all the men except the highest chiefs. Another fashionable custom there requires the friends and relatives of the deceased to assemble on the fourth day after the funeral, and picture to themselves the amount of corruption the corpse has sustained by that time. In the Sandwich Islands persons desirous of going into mourning, paint the lower part of their faces black, and knock out their front teeth.

Sicilian Funeral Customs.—In past ages a piece of money was put into the mouth of the corpse—a survival of the fare which Charon was bound to receive. A virgin has a palm branch and a crown in her coffin; a child a garland of flowers. It is the worst possible omen for a bridal pro-

cession to meet a funeral. It has to be averted by making the "horns," or "le fêche" (thrusting the thumb between the first two fingers), or by putting a pomegranate before the door or in the window. At Piano de Greci, certain little loaves or bread cakes in the form of a cross are given to the poor on the day of a death. In Giacosa, behind the funeral procession comes an ass laden with food, which, after the burial, is distributed either in the open or under cover in some house. The Sicilian Albanians do not sit on chairs during the first days of mourning, but on the dead man's mattress. In some houses all is thrown into intentional confusion—turned upside down to mark the presence of death. Others put out the mattress to show that the invalid is dead; others again remake the bed as for marriage, placing on it the crucifix which the sick man had held in his hand when dying. Woe to those who let the candle go out while burning at the foot of the bed! On the first day of mourning there is only one of these corpse-lights; on the second day, two; on the third, three. Men and women sit round—the men covered up in their cloaks with a black ribbon around their throats, the women with their black mantels drawn closely over the head, all in deep mourning. For the first nine days friends, also in strict deep mourning, throng the house to pay their formal visits of condolence. The mourners do not speak or look up, but sit there like statues and talk of the dead in solemn phrases and with bated breath, but entering into the minutest and sometimes most immodest details. The mourning lasts one or two years for parents, husband or wife and brothers and sisters; six months for grandparents and uncles and aunts; three months for a cousin.

Cashmere Women.—Cashmere has long been famous for its beauty. "Who has not heard of the Vale of Cashmere?" sings a poet. It is an irregular oval, shut in by snow-clad mountains, with a rich soil, yielding flour, fruit and grain, with useful minerals—iron, copper, lead, plumbago. But neither its beauty nor its fertility could keep out war and pestilence. Scourged by these, the kingdom of Cashmere, of which the Valley alone contained nearly a million of people, now sees all its provinces number only three-quarters of that amount. The Cashmerians are pre-eminent among Indian nations for their physical perfection. The men are tall, well-formed, robust and industrious, manufacturing shawls, guns, paper, lacquered ware and attar of roses. The women are famous for their beauty and fine complexion. They are a gay people, fond of pleasure, literature and poetry. The men are distinguished by their mode of wearing the turban. The women wear a red gown, with large, loose sleeves, a red fillet on the forehead, over which is thrown a white mantilla. The hair is collected in separate plaits, then gathered together, and a long tassel of black cotton is hung from it, almost down to the ankles. Cashmere was conquered by Akbar in 1586; by the Afghans in 1752; by the Sikhs in 1819; and by the English in 1846.

Women in Tunis.—Women are kept much stricter in Tunis than in Egypt or Turkey. Moorish ladies of high standing never show themselves in the street; and there are thousands of them whose only walk during their whole lives has been from the house of their parents to that of their husbands. Poor women have to go out to make their purchases, and also to go to public baths, as they have none in their own houses; but they are veiled to such a degree, and enveloped in so many shawls, that you can scarcely see the tips of their fingers. The women of the middle classes also wear a dark, heavy silk handkerchief, and you only see their feet clothed in little

slippers, either embroidered with gold or of patent leather, and perhaps a little bit of the calf, dressed in a snow-white stocking, ornamented with silver or golden clasps, which clink at every step like spurs. Woe be to the European who, in the presence of men, were to stare at a Moorish woman or accost her! The Moors are, both in respect of their religion and their women, the greatest fanatics; and to pursue a woman, or to enter a mosque, may cost one's life to this day.

The Land of the Midnight Sun.—Nothing strikes a stranger more forcibly, if he visits Sweden at the season of the year when the days are longest, than the absence of night. Dr. Baird relates some interesting facts. He arrived in Stockholm from Gottenburgh, four hundred miles distant, in the morning, and in the afternoon went to see some friends. He returned about midnight, when it was as light as it is in England half an hour before sunset. You could see distinctly, but all was quiet in the streets; it seemed as if the inhabitants had gone away or were dead. The sun in June goes down in Stockholm a little before ten o'clock. There is a great illumination all night, as the sun passes round the earth toward the north pole; and the refraction of its rays is such that you can see to read at midnight without any artificial light. The first morning Dr. Baird awoke in Stockholm, he was surprised to see the sun shining in his room. He looked at his watch and found it was only three o'clock. The next time he awoke it was five o'clock, but there were persons in the street. There is a mountain at the head of Bothnia, where, on the 21st of June, the sun does not appear to go down at all. The steamboat goes up from Stockholm for the purpose of conveying those who are curious to witness the phenomenon. It occurs only one night. The sun reaches the horizon, you can see the whole face of it, and in five minutes more it begins to rise. At the North Cape, latitude seventy-two degrees, the sun does not go down for several weeks. In June it would be about twenty-five degrees above the horizon at midnight. In the winter time the sun disappears and is not seen for weeks; then it comes and remains for ten, fifteen, or twenty minutes, after which it descends, and finally does not set at all, but makes almost a circle around the heavens. Birds and animals take their accustomed rest at the usual hour, whether the sun goes down or not.

A Tyrolese Custom.—In the mountains of Tyrol, it is the custom of the women and children to come out, when it is bedtime, and sing their national songs until they hear their husbands, fathers and brothers answer them from the hills or on their return home. On the shore of the Adriatic such a custom prevails. There the wives of the fishermen come down about sunset and sing a melody. After singing the first stanza, they listen awhile for the answering strain from off the water, and continue to sing and listen till the well-known voices come borne on the tide, telling that the loved ones are almost home.

THE WORLD ILLUSTRATED.

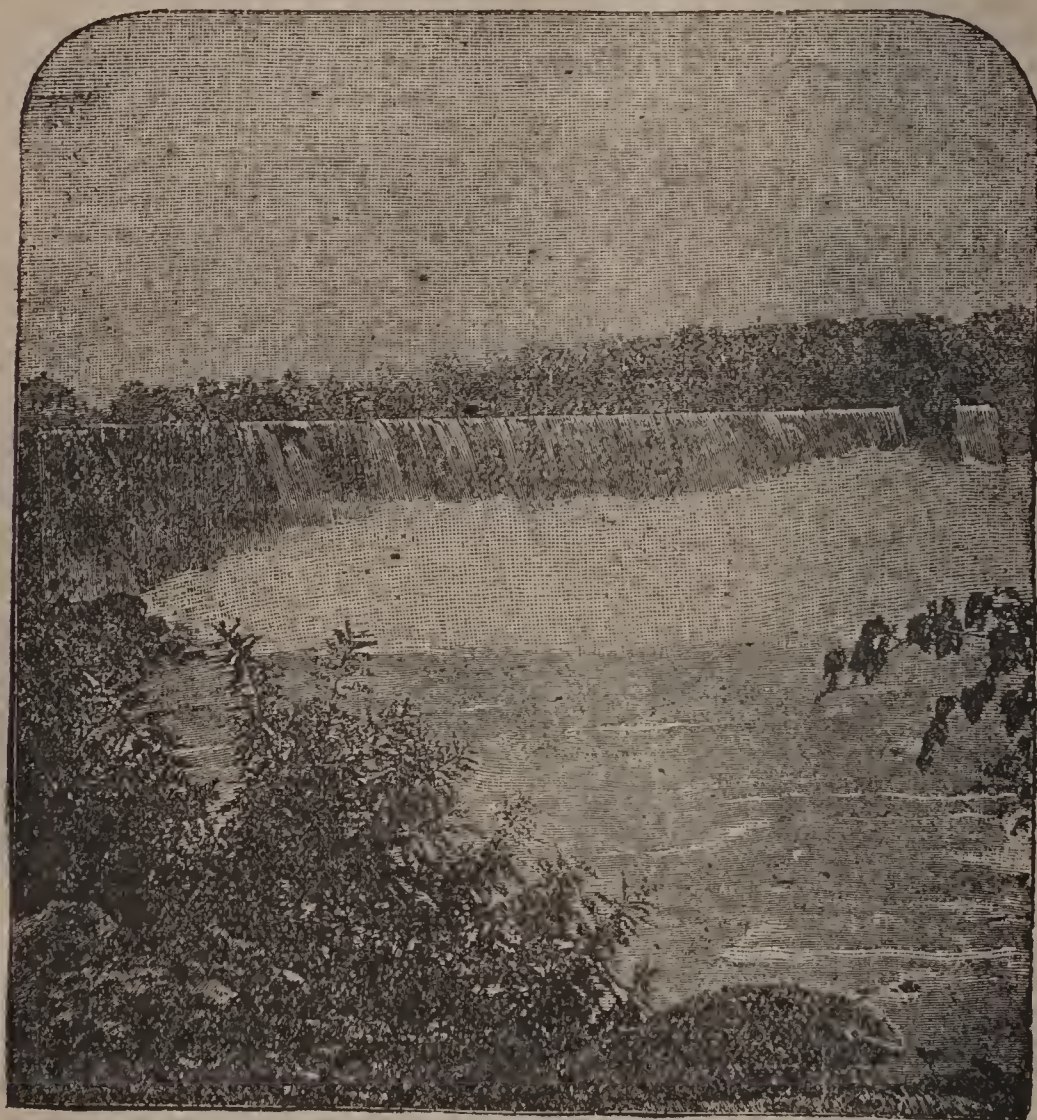
Niagara Falls.—The largest, grandest and most magnificent cataract in the world is the world-famous Falls of Niagara. The Niagara River, which flows northward from Lake Erie to Lake Ontario, forms the only out-



NIAGARA FALLS FROM BELOW.

let of Lakes Superior, Michigan, Huron and Erie, hence the entire flow of waters from these mammoth lakes must pass over the cataract. The river is about thirty-six miles in length, and its descent from the level of the one lake to that of the other is about three hundred and thirty-four feet. On issuing from Lake Erie, it is three-quarters of a mile broad; but as it flows on, it becomes several miles wide, making room for a number of islands, the largest of which, Grand Island, is twelve miles long, and from two to seven broad. At the foot of Grand Island, which reaches within one and a half

miles of the Falls of Niagara, the river is contracted to a breadth of two and a half miles, and grows narrower as it proceeds. By this, and by the descent in the channel, which is about sixty feet in the mile above the Falls, are produced the swift currents known as the Rapids, in which the river, notwithstanding its great depth, is perpetually white with foam. At the Falls, which are twenty-two miles from Lake Erie, the river is divided by an island containing about seventy-five acres, called Goat Island; but in consequence of a bend in the channel, by far the larger portion of the water



THE HORSESHOE FALL, NIAGARA.

is sent down by the Canadian side. On this side, therefore, is the grander cataract, which has been named the Horseshoe Fall, but no longer bears the name appropriately, as the precipice has been worn from a curved into a somewhat angular shape. This process of wearing away still goes on, a large projection on the Canadian bank, known as the Table Rock, having partly fallen off in 1863. The Horseshoe Fall is above six hundred yards in breadth, and about one hundred and fifty-four feet in height. The water is so deep that it retains its green color for some distance below the brow of the precipice; and it rushes over with such force, that it is thrown about fifty feet from the foot of the cliff. One may thus, having donned an oil-skin dress, enter two

or three yards behind the curved sheet of water; but the spray is so blinding, the din so deafening, and the current of air so strong, that it requires a tolerably calm nerve and firm foot. The separation caused by Goat Island leaves a large wall of rock between the Canadian and American Falls, the latter being again divided by an islet at a short distance from Goat Island. This fall is from eight to ten feet higher than the Horseshoe, but only about two hundred and twenty yards broad. A little above the Fall, the channel is divided by Bath Island, which is connected by bridges with Goat Island and the American shore. A small tower, approached from Goat Island, has been built on a rock over the brow of the Horseshoe Fall; and from this the finest view on the American side may be obtained, the Table Rock on the Canadian side giving the completest view of the entire cataract. The Falls



RAPIDS OF THE ST. LAWRENCE.

can also be seen from below on both sides, and every facility is given for viewing them from all the best points, while magnificent hotels, Canadian and American, offer their inducements to the tourist to stay till he has received the full influence of the scenery. The river is crossed about two hundred or three hundred yards below the Falls, where it is twelve hundred yards broad. The current is lessened for about a mile, but increases again as the channel becomes narrower and the descent greater. Between three and four miles below the Falls, a stratum of rock runs across the direct course of the river, which, after forming a vast circular basin, with an impassable whirlpool, is forced away at right angles to its old channel. The celebrated wire suspension-bridge for the Great Western Railway, with a road beneath for vehicles and foot passengers, crosses the river one and a half miles below the fall: it is eight hundred feet long, forty broad, and two hundred feet above the surface of the water. We present illustrations of the American Fall, as seen from below, and of the Horseshoe Fall.

The Rapids of the St. Lawrence.—The St. Lawrence River, which flows from Lake Ontario to the sea, forming the outlet of the entire chain of great lakes in America, is remarkable for its beautiful scenery. Here are located the famous Thousand Islands, and the shores of the river throughout its entire length are picturesque in the extreme. From the Thousand Islands to Montreal a succession of rapids occur, the most famous of which are the Rapids of Lachine, a few miles above Montreal, of which our illustration is a faithful delineation. Large steamers pass over these Rapids, taking the course of the channel and descending within a few feet of the rocks on either side, and “shooting the Rapids” is an experience long to be remembered by the traveler. No boat can ascend

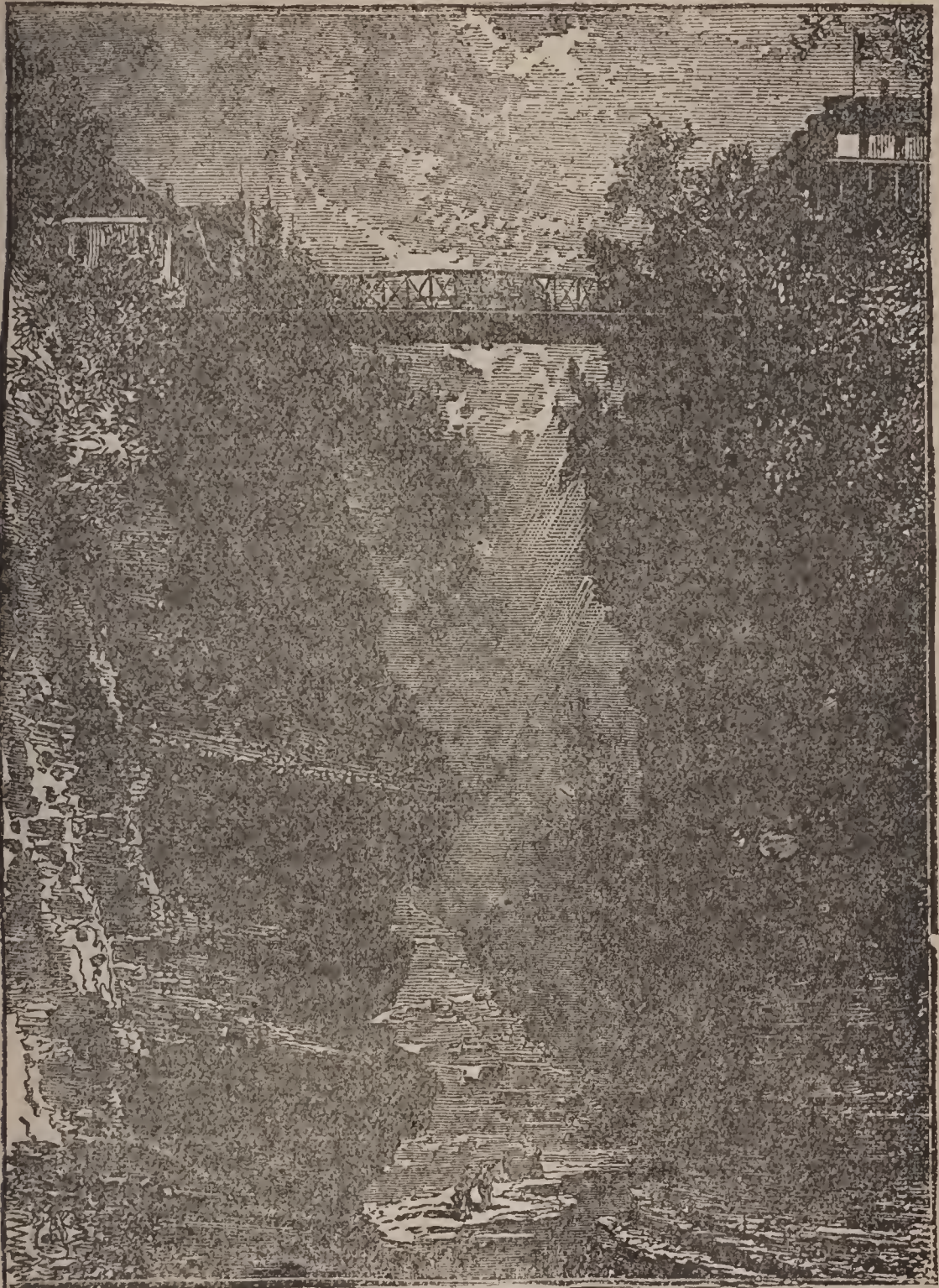


FRANCONIA NOTCH, WHITE MOUNTAINS.

the river above Montreal, but must pass through the canal which has been provided for this purpose.

Franconia Notch, White Mountains.—The White Mountain group proper and the Franconia group are separated from each other by a table land varying from ten to twenty miles in breadth. Of the “notches,” or passages rent through the solid granite of the mountains, there are five, those most celebrated being the White Mountain Notch, two miles in length and only twenty-two feet wide, and the Franconia Notch, which permits the passage of the Pemigewasset. The flume of the Franconia Notch is the most noted of those narrow waterways. Among the other objects of interest in the Franconia group is the “Old Man of the Mountain.” At the base of the mountain lies a beautiful lakelet called Profile Lake. The White Mountains are famous for grand and beautiful scenery.

Watkins Glen.—The famous Watkins Glen is located in Schuyler County, New York, at the head of Seneca Lake. It is a narrow gorge or defile, about three miles in length, cut hundreds of feet in depth in the rocky hills. It consists properly of a number of glens or sections, rising



WATKINS GLEN.

one above another and forming a series of rocky arcades, galleries and grottoes, and forms the channel for a limpid stream, which descends from section to section by a myriad of cascades and rapids. The Rainbow Fall, Artist's Dream, Cavern Cascade and Cathedral are most celebrated.

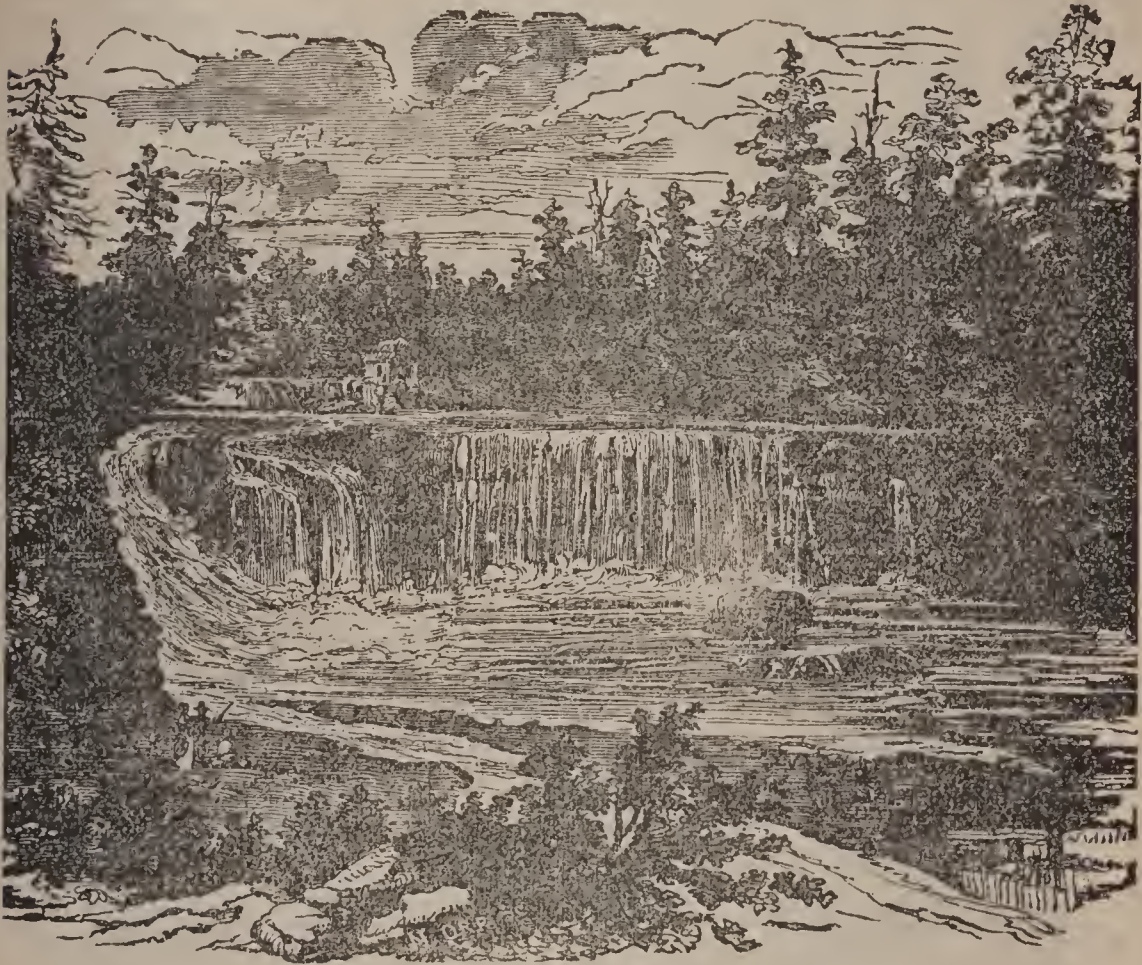
Fawn's Leap, Catskill Mountains.—The Catskill Mountains, in Greene County, New York, are a part of the Appalachian system. The group runs nearly parallel with the Hudson River, from which the mountains are distant about eight miles. The region gained a world-wide celebrity during the lifetime of Washington Irving, who made it the scene of his most beautiful legends. The chief interest of the Catskills lies in the variety and beauty of their scenery. They present a multitude of picturesque objects, which have long made them a favorite resort of artists and other lovers of the grand and beautiful in nature. The highest peak is the Overlook Mountain, three thousand eight hundred feet above the sea level, from the summit of which may be obtained a grand view, stretching from the Green Mountains, in Vermont, to the highlands of West Point, and



FAWN'S LEAP, CATSKILL MOUNTAINS.

including one hundred miles of the Hudson River valley. The Hunter Mountain, High Peak and Round Top are also high and commanding elevations. The Kaaterskill Clove, a remarkable ravine five miles in length, lies between the lake and Round Top. "The mountains divide like the cleft foot of a deer," leaving a deep hollow into which the brook plunges over a cascade one hundred and eighty feet in height. This fall is called the "Fawn's Leap." There are also many other beautiful cataracts in the Kaaterskill region. The recent completion of railroad lines leading to the very heart of the mountains, and the erection of several new and expensive hotels, has made the Catskills of late years more popular than ever.

Trenton Falls, New York.—A series of six cataracts, within the distance of two miles, with an aggregate descent of three hundred and twelve feet, constitute the picturesque and romantic Trenton Falls, which are a part of the West Canada Creek, the main branch of the Mohawk River. The stream flows through a narrow gorge from one to two hundred feet deep, and in a succession of beautiful cascades and cataracts the water plunges with great violence. Mr. J. David Williams, editor of "America Illustrated," describes the Falls as follows: "It is not a mere waterfall or series of waterfalls. It is a gigantic millrace, running for three miles between walls of solid rock, nature's masonry, twice as high as Trinity steeple, and in many



TRENTON FALLS, NEW YORK.

places almost as perpendicular. Through this gorge run the waters of West Canada Creek; now corkscrewing their way through a rocky path, water hewn; now precipitating themselves by a series of cascades into an amphitheatre whose rugged sides of rock are clothed in leafy green; now flowing in a rapid stream over a bed as smooth, and composed of stones as regular and rectangular as those of a city sidewalk; now pouring over a rocky dam so straight and formal that you instinctively look for a sawmill at its base; now leaping down a two-storied cascade in a series of falls whose wondrous variety of beauty is beyond the power of pen or pencil to describe; now darting over a bed of rough rocks which throw it into foam and eddies and waves that are like a miniature surf; now gathering all its volume into one concentrated column and plunging through a narrow gap, beating like a gigantic trip-hammer on the rocky bed beneath, finally to hurry swirled and

twisted and writhed into innumerable forms through a narrow defile, to issue at last in a deep and to the eye an unfathomable pool of treacherous calm at the very edge and mouth of the stony chasm. * * * * At the point in the Falls where the greatest volume of water descends, the rocky walls on either side are much nearer each other than at other places, giving the fall at a distance the appearance of water rushing through a great flood-gate. The waters rush along with an impetuous and unnecessary haste that is thoroughly American—every drop is unmistakably native-born. The walls are almost perpendicular below the Falls, and in many places the sky is scarcely visible from the banks of the creek. There is a ladder built from the base of the great cataract to the plateau above it, and tourists can climb up and view the falls at the spot where the first descent begins. The spectacle here witnessed is more than compensation for the exertion.” * * * *



THE BARTHOLDI STATUE.

The Bartholdi Statue.—The great Bartholdi statue, “Liberty Enlightening the World,” erected upon Bedloe’s Island in New York Bay, was the gift of France to the American people. It is said that this gigantic work cost \$250,000, the expense being borne by 250,000 Frenchmen of the middle class, each of whom contributed the sum of one dollar. Bartholdi, the sculptor, was eight years constructing the statue. The figure is made of hammered copper sheets, one-eighth of an inch thick. These are riveted together, and fastened to a four-sided iron frame which runs up through the center of the figure, and is firmly fixed to the pedestal. It is the largest statue of which any knowledge is preserved. The Colossus of Rhodes was said to be ninety feet high, the statue of “Bavaria,” at Munich, is sixty feet high. The height of the Bartholdi statue, including the pedestal and foundation, is 305 feet. It towers above the Brooklyn Bridge pillars and the steeple of Trinity Church. It weighs 220 tons. Some estimate of the size of this colossal figure may be formed from the dimensions of the forefinger. It is eight feet long, and four feet nine inches around at the second joint. The head is fourteen and a half feet high, and the nose three feet seven inches long. A man six feet tall standing upon the level of the lips, would just reach the eyebrows. Fifteen people may sit around the flame of the torch. A staircase ascends inside from the bottom of the statue quite up into the torch. There the climber can go outside to a circular balcony, with a railing, around the torch. The view here of New York harbor and city, the Brooklyn Bridge, the Hudson River and heights, the bay and the ocean, is one of the most magnificent in America.

The Palisades of the Hudson River.—The Hudson River has been appropriately called the American Rhine from the picturesque and roman-

tic character of its scenery. Its source is in the Adirondack Mountains and its mouth is New York Bay. It is navigable to Albany, a distance of 160 miles. It winds its way gracefully among mountains, hills and forests, its surface smooth and bright as a mirror, forming a scene of Eden-like beauty. From Fort Lee, N. J., opposite the upper portion of Manhattan Island, to Piermont, N. Y., the west bank of the river consists of a precipitous rocky wall called the Palisades. This wall is of trap-rock, and rises almost straight



THE PALISADES OF THE HUDSON RIVER.

and perpendicular from the river's brink to a height of from three to six hundred feet, and extends a distance of fifteen miles. The Hudson River was first explored in 1609 by Henry Hudson, an English navigator, who ascended to the present site of Albany. Robert Fulton made his first successful experiments in steam navigation upon this river. During the war of the Revolution it was the scene of many important engagements, and some of the old Revolutionary fortifications and other structures are still preserved.

The Allegheny River.—This beautiful stream rises in the northern part of Pennsylvania, from whence it flows to Pittsburgh, where it unites with the Monongahela to form the Ohio. It is navigable for nearly 200 miles above Pittsburgh. For the greater part of its course it flows through



THE ALLEGHENY RIVER.

a great ravine, from one to two hundred feet below the level of the adjacent country. The scenery in some places is wild and rugged, but more generally is picturesque and beautiful. The hills are clothed with a dense forest, and washed at their base by the limpid water. In all Pennsylvania there is no scenery more picturesque than that of the Allegheny River.

Natural Bridge, Virginia.—In Rockbridge County, Virginia, is to be found one of the greatest curiosities in the United States. Spanning a small and unimportant creek (The Cedar) is this world's wonder—the Natural Bridge. This bridge consists of a stupendous arch of limestone rock, over a chasm fifty feet wide at its base, and ninety feet at the top. The



NATURAL BRIDGE, VIRGINIA.

height of the bridge above the stream, to the top, is two hundred and fifteen feet; its average width is eighty feet; its extreme length at top, ninety-three feet, and its thickness, from the under to the upper side, fifty-five feet. A clayey earth covers it to the depth of from four to six feet, and it possesses a natural parapet of rock at the sides, rendered firm by rocks and trees. The view from above is grand, but the best prospect is obtained from beneath, where the astonished spectator has full scope to grasp, at a single glance, this magnificent work of nature. The beauty, elevation, and light,

ness of the arch present a striking instance of the graceful in combination with the sublime.

Gothic Chapel, Mammoth Cave, Kentucky.—The Mammoth Cave is in Edmonson County, Kentucky. It extends nine miles underground, and embraces a great variety of subterranean chambers. The



GOTHIC CHAPEL, MAMMOTH CAVE, KENTUCKY.

Gothic Chapel is in what is known as the Gothic Arcade, and is entered from the main cave by ascending a flight of steps some fifteen feet in height. The Chapel is a large room, the ceiling of which appears to be supported by gigantic stalactites, which extend to the floor. When a number of lamps are hung upon these columns, or carried in the hands of visitors, the Chapel presents a beautiful appearance. There are many circumstances to prove that the Mammoth Cave is part of the course of a subterranean river which existed in a former condition of the surface. Geologists assign a million years as the approximate term for the production of this series of caves.

Silver Springs, Florida.—The St. Johns River is said to be in many respects the most remarkable in North America. It has its source in the Everglades of Central and Southern Florida; and after running due north for two hundred miles, it abruptly turns eastward to the ocean. Some distance up this strange river is the famed Silver Springs, a great, deep and surprisingly clear basin of water, which boils up from the bowels of the earth with much force, forming a river one hundred feet in width, and which, in the course of seven miles, forms a junction with the Ocklawaha. This spring is seventy feet deep, as clear as crystal, and remarkably fresh and



SILVER SPRINGS, FLORIDA.

cool. "The steamboat on the surface," writes Mr. Louis M. Babcock, editor of "Our American Resorts," describing the Silver Springs, "rests on an inverted *fac simile*, and every tree, twig, vine and rock is reproduced in the beautiful pool. The floor of this basin is silver sand, studded with curious figures in pale, green-tinted lime crystals. A row across the pool is ever to be remembered. Every object that has been dropped into the water by preceding visitors lies in the silver setting, a rich emerald gem. At one place a barely discernible bubbling points out the spot from which the water gushes out, thousands of gallons, every moment. A stone dropped toward the slight ledge of limestone rock twenty-five feet below, is suddenly thrown in a curved line nearly to the surface by the rush of the spring from under the rock."

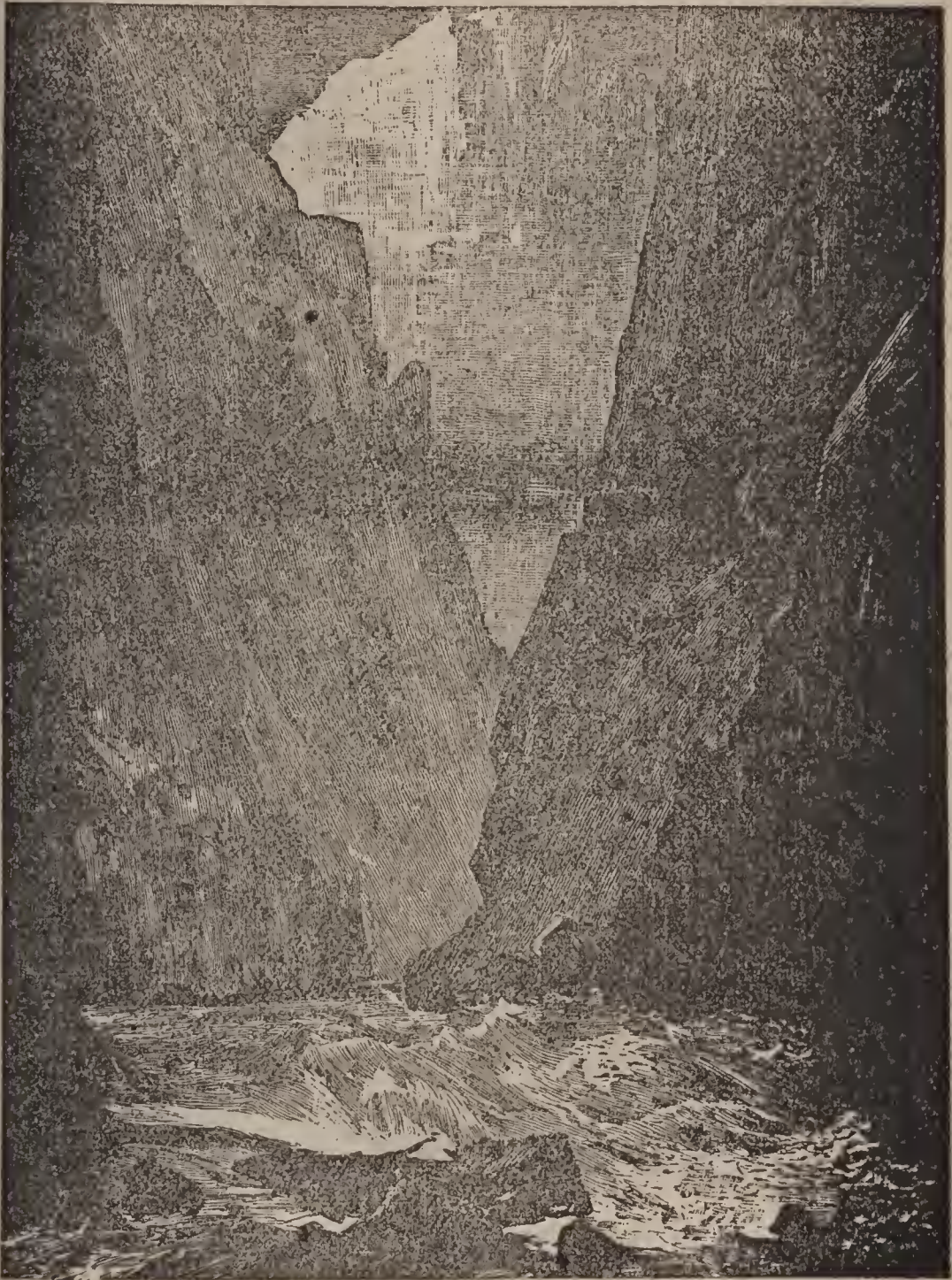
Silver Cascade, St. Anthony's Falls.—The Falls of St. Anthony, in Minnesota, received their name from Father Louis Hennepin, a French missionary, by whom they were discovered in 1680. The entire river, which exceeds two hundred and fifty yards in width, falls perpendicularly a dis-



SILVER CASCADE, ST. ANTHONY'S FALLS.

ance of thirty feet, forming a beautiful cataract. The rapids below, in a space of three hundred yards, render the descent considerably greater, so that, when viewed from a distance, the falls appear much higher than they really are. The surrounding country is very picturesque. A short distance below the falls is a small island, where grow many large oak trees, upon which hundreds of eagles build their nests. The Silver Cascade shown in our illustration is a very beautiful fall, within easy driving distance from Minneapolis.

Grand Canon of the Colorado.—The scenery of the Rocky Mountains is not surpassed in grandeur and magnificence by the famous Alps of Switzerland. In fact, in the matter of their wonderful river canons or ravines



GRAND CANON OF THE COLORADO.

they have no parallel in any part of the world. These canons are cut thousands of feet into the heart of the mountains, and through this dark and rocky gorge the turbulent river winds its way. The Grand Canon of the Colorado is two hundred and forty miles long, and from two thousand five hundred to four thousand feet deep. Its walls are of solid rock, in some places nearly perpendicular, and almost entirely shutting out the light of day.

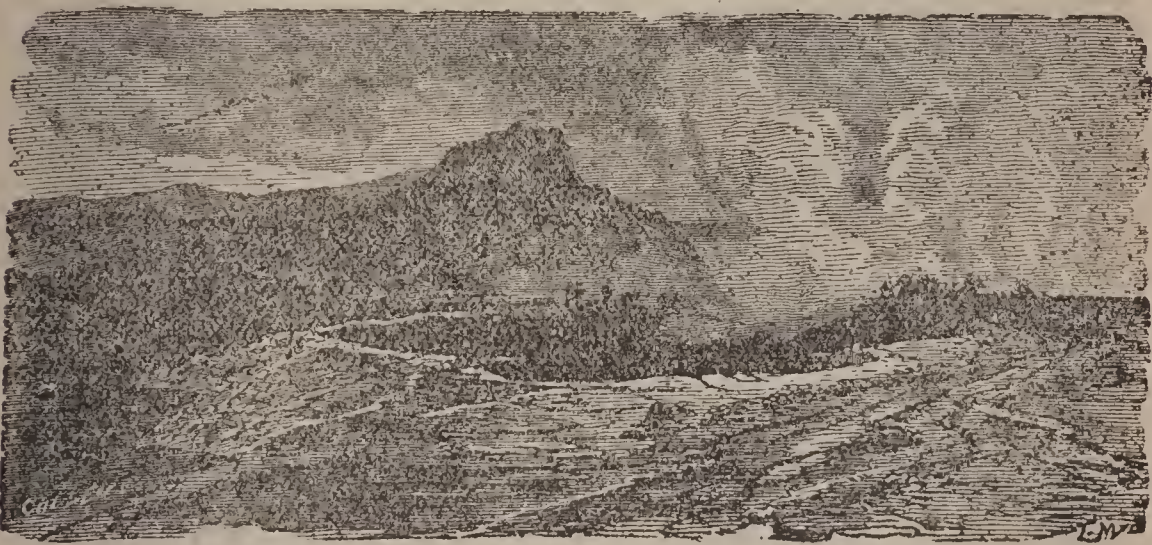
Great Falls of the Missouri River, Montana.—The Missouri River is not only the chief affluent of the Mississippi, but the largest tributary stream in the world. It is three thousand and ninety-six miles long, and is navigable at high water to the Great Falls, two thousand five hundred and forty miles from the Mississippi. The upper Missouri is remark-



GREAT FALLS OF THE MISSOURI RIVER, MONTANA.

able for its scenery. At a distance of four hundred and eleven miles from its source, it flows through a gorge five and three-quarter miles in length, between perpendicular walls one thousand two hundred feet high and four hundred and fifty feet apart. At the Great Falls, one hundred and ten miles below, the river falls three hundred and fifty-seven feet in a series of rapids and cascades extending over a distance of sixteen and one-half miles. The largest fall is eighty-seven feet high, and the scenery is full of grandeur,

The Yellowstone Park.—The Yellowstone River rises in a beautiful lake of the same name high up in the Rocky Mountains, and receiving numerous branches from the south, flows northeasterly through the territory of Montana, and empties into the Missouri River, in the northwest part of Dakota Territory. It is eight hundred yards wide at its mouth, one thousand miles long, and navigable seven hundred or eight hundred miles. The region of the Yellowstone and its source was for the first time explored by parties from the United States in 1870 and 1871, and seems to be one of the most wonderful spots on the earth. Making their way up the river through the grand scenery of the Rocky Mountains, the explorers came to a district of a square mile in area, filled with hot springs in active operation, which cover the hillsides with snowy white deposit like a frozen cascade. Three or four miles around were occupied by springs which have ceased to flow. They are about six thousand feet above the sea, and are much resorted to by invalids. This was but the beginning of the wonders. Next they came to a terrific rift, two thousand feet in depth, with a river rolling in its deeps,

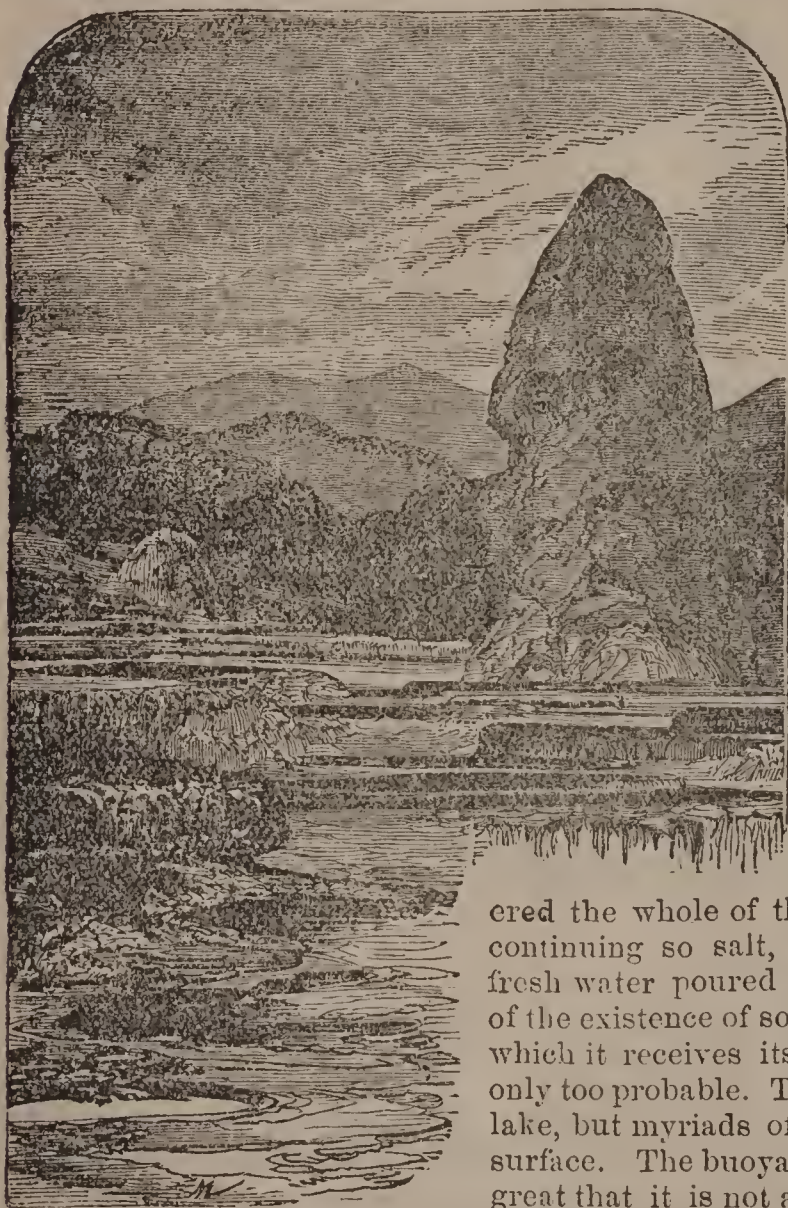


GREAT SPRINGS, YELLOWSTONE PARK.

“a grand, gloomy, terrible place.” At the head of this canon are the Tower Falls, with a sheer descent of four hundred feet. The Grand Canon, however, throws this into the shade. This fearful abyss is three thousand feet in perpendicular height, and to one looking up from the bottom, stars are visible in broad daylight. The ravine is full of hot springs of sulphur, sulphate of copper, alum, steam jets in endless variety, some of most peculiar form. The grandeur of the canon is at once heightened and diversified by the Upper and Lower Falls; the latter one unbroken symmetrical expanse, three hundred and fifty feet in height. Between this fall and the lake lies a region full of boiling springs and craters, with two hills three hundred feet high, formed wholly of the sinter thrown from the springs, one of which is seventy feet long by forty broad. Still farther on they came to a valley containing about one thousand five hundred geysers, some throwing up immense columns of water to the height of more than two hundred feet—a stupendous spectacle! The lake from which the river issues is about three hundred square miles in area, is situated seven thousand four hundred and twenty-seven feet above the level of the sea, and is described as “the gem to which all the other wonders form the setting.” In one sec-

tion there is an extinct geyser, which from its old eruptions has built up a cone of lime forty-two feet high and twenty-two feet in diameter at the base. This cone has been called "The Cap of Liberty." The wonderful Yellowstone region has been set apart by the government of the United States as a permanent public park, and is called the Yellowstone National Park.

Salt Lake, Utah.—Four barrels of water of the Great Salt Lake will



LIBERTY CAP, YELLOWSTONE PARK.

leave after evaporation nearly a barrel of salt. The lake was discovered in the year 1850, and no outlet has yet been ascertained. Four or five large streams empty themselves into it, and the fact of it still retaining its saline properties seems to point to the conclusion that there exists some secret saline deposits over which the waters flow, and thus they continue salt—for though the lake may be the residue of an immense sea which once cov-

ered the whole of that region, yet by its continuing so salt, with the amount of fresh water poured into it daily, the idea of the existence of some such deposit from which it receives its supply seems to be only too probable. There are no fish in the lake, but myriads of small flies cover its surface. The buoyancy of the water is so great that it is not at all an easy matter to drown in it. The entire length of Salt Lake is eighty-five miles. Compared with

the Dead Sea, Salt Lake is longer by forty-three miles, and broader by thirty-five miles.

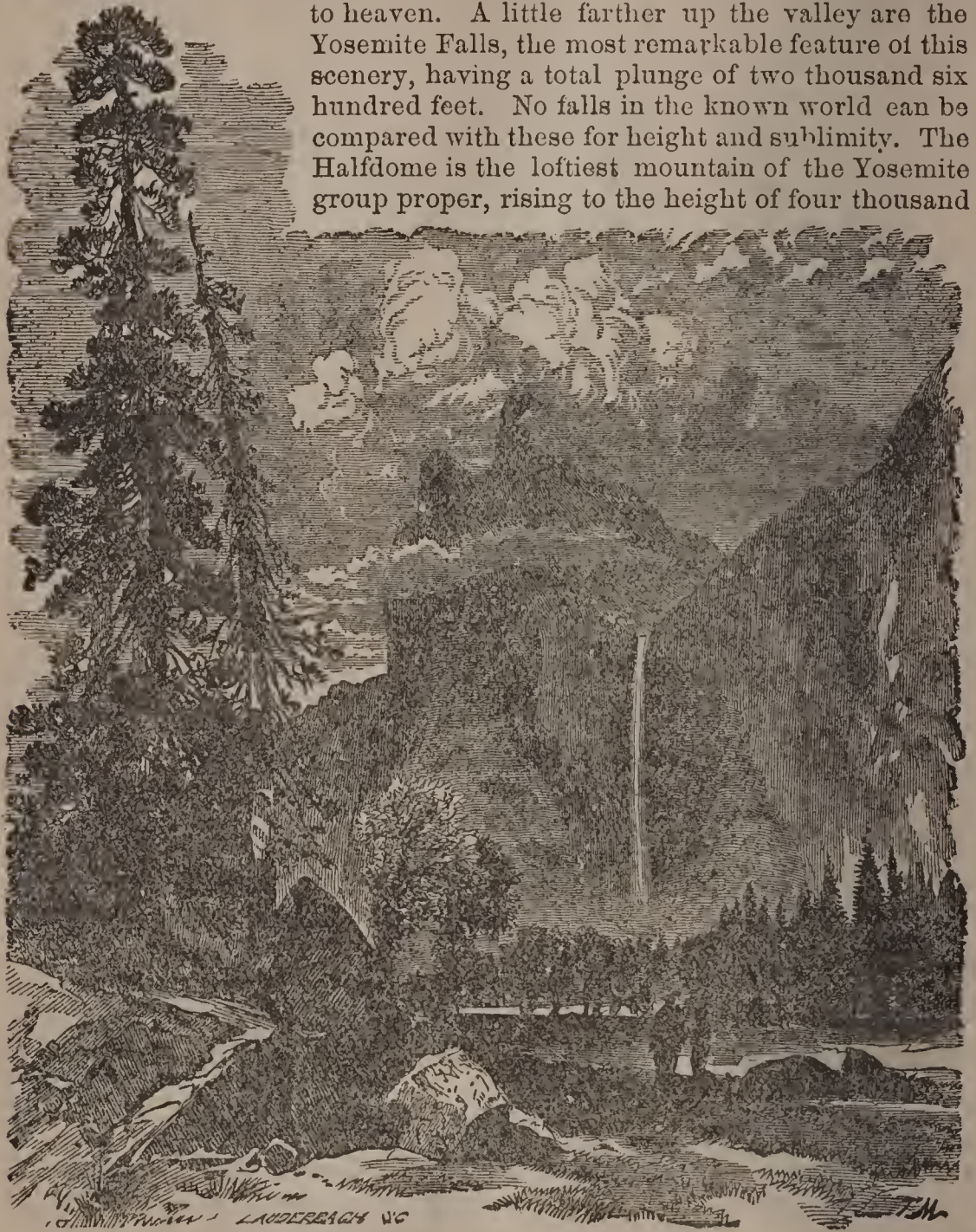
The Yosemite Valley.—One hundred and forty miles east of San Francisco, on the western slope of the Sierra Nevadas, thirty miles from their summit, and at an elevation of over four thousand feet above the level of the sea, lies the pride of California, the boast of the United States, and one of the great wonders of the world—the Yosemite Valley. It is about the center of the State, and is a nearly level area some six miles long and half a mile to a mile wide. It is almost a mile in perpendicu-

lar depth below the general level of the adjacent region, and is enclosed in frowning granite walls rising with almost precipitous faces to the astonishing height of from three thousand to six thousand feet. From the brow of the precipice, here and there, spring streams of water which form cataracts of a loveliness unknown elsewhere among mountain scenery. The unparalleled characteristic of the Yosemite is its incredible compactness. Almost one single *coup d'œil* can cover it. Within a minute space it encloses unequaled wonders. It is one vast flower garden; plants, shrubs, flowers of every lovely form and hue cover the ground like a carpet. The eye is dazzled with color. The air is heavy with fragrance. The stately pines that fringe the valley between the tremendous cliffs, look like daisies in the midst of pines. The warder of the Valley is the mountain El Capitan. Though not so high by half a mile as some of its neighbors, it is more noticeable from its isolation and its perpendicular sides, down which one could almost drop a plummet from the top. It is probably the most square-cut and imposing face of rock in the world. Opposite El Capitan is that beautiful fall, the Bridal Veil, where the creek leaps from the sheer edge of the cliff nine hundred feet into the valley below, being dispersed in mist and vanishing in



GREAT GEYSER, YELLOWSTONE PARK.

spray long before it reaches its rocky bed. Falling behind one high shoulder of El Capitan is the Virgin's Tears, dropping one thousand feet. Not far from here are the sculptured piles of granite, known as the Cathedral Rock, the Spires, the Three Brothers, the Sentinel, etc., rising like vast cathedrals to heaven. A little farther up the valley are the Yosemite Falls, the most remarkable feature of this scenery, having a total plunge of two thousand six hundred feet. No falls in the known world can be compared with these for height and sublimity. The Halfdome is the loftiest mountain of the Yosemite group proper, rising to the height of four thousand



BRIDAL VEIL FALL, YOSEMITE VALLEY.

seven hundred and thirty-seven feet above the valley, or nine thousand feet above the sea. We have not space to enumerate a tenth part of the marvels of this awe-inspiring and romantic valley, and the only way the tourist can get an adequate conception of them is by climbing some of the numerous "trails" that have been worn in their sides from bottom to top. This can be done on foot, or, by almost all trails, on a mule. The bridle-paths are firm and well made.

The Summit of the Sierras.—The Sierra Nevada Mountains have been appropriately styled the California Alps. Their grandeur is seen in the fact that throughout the extent of the range, four hundred and fifty miles, there is not a pass lower than eight thousand feet above the level of the sea. It is a grand and exciting ride on the Pacific Railroad down the Sierras, from Summit to Colfax; and here, as at all the passes, especially at the head, the scenery is of the wildest and grandest description—lofty peaks massed together and laden around their bases with ice and snow; chains of glacier lakes, cascading streams in endless variety, with glorious views eastward and westward. As he proceeds down the mountains the eye of the tourist is greeted with every variety of mountain scenery, giving a quick succes-



THE SUMMIT OF THE SIERRAS.

sion of magnificent views and striking contrasts—fearful chasms and tortuous canons, towering peaks, giant pines and diminutive manzanitas, sparkling creeks, rushing rivers and romantic cascades, gloomy gorges and fruit-laden orchards, and woven through all a new and bold civilization—huge smelting furnaces, thundering quartz mills, old placer diggings and new mines tunneling the alabaster. On every hand we see the miner's work. Long flumes carry off the washed gravel and retain the gold; turbulent ditches bear the debris to the plains below; here is a hose playing against the hillside and bringing down acres of "pay dirt." **AN** is life, energy, activity. In a run of fifty miles upon this railroad the descent is more than six thousand feet.

Cape Horn, in the Sierras.—From the hour the traveler leaves Omaha for California, he finds everything new, curious and wonderful; the plains, with their buffalo, antelope and prairie dogs; the mountains, which, as you approach Cheyenne, lift up their glorious snow-clad summits; the grim scenery of the canons and gorges; the indescribable loveliness and beauty of the mountain range which shelters Salt Lake City; the extended alkali and sage brush plain; the snow sheds which protect the Central Pacific as you ascend the Sierras, and, on the morning of the last day of your journey, the grand and exciting rush down the Sierras from Summit to Colfax, winding around Cape Horn and half a hundred more precipitous cliffs, down which you look out of the open “observation car” as you sweep



CAPE HORN, IN THE SIERRAS.

from a height of seven thousand feet to a level of two thousand five hundred feet in a ride of two hours and a half. A grander or more exhilarating ride than this cannot be found in the world, the scenery is so varied, novel and magnificent.

In Arctic Seas.—The manifestations of nature in the Arctic region are magnificent and marvelous. The ice assumes many fantastic shapes, at times presenting all the colors of the rainbow. The interior of Greenland is covered with ice and snow to a great depth. This vast mass is constantly moving towards the water, and when it reaches the edge of the land it tumbles over into the sea, breaking off in immense fragments. Our illustra-

tion represents a ship in danger of being crushed by the iceberg just tumbling over into the sea.

The Catacombs of Rome.—The catacombs of Rome are believed to be of great antiquity, they probably having been hewn long before Romulus and Remus founded Rome. In the course of time they were extended so that every one of the seven hills on which the city stood was perforated and honey-combed by passages, dark galleries, low corridors, and vaulted halls. What greatly facilitated the work was the light and soft nature of the material to be quarried, and the workmen were thus enabled to shape the shafts and galleries as they pleased. As the city grew in extent and wealth



IN ARCTIC SEAS.

these quarries were enlarged and new ones opened. The material was used in building houses and temples. But little is to be gleaned from the ancient writers as to the uses to which these subterranean recesses were put when they ceased to be quarries. Horace says of the caverns under the Esquiline Hill that it "was the common sepulchre of the miserable plebeians." The catacombs were crowded with the Christians during the persecutions under Nero, Domitian, Trajan, Adrian, Severus, Maximinus and Diocletian, who found there safety from the tyranny of the Roman pagans. Each catacomb forms a network of passages, or galleries, intersecting each other at right angles, but sometimes diverging from a common center; these galleries, or passages, are usually about eight feet high, and

from three to five feet wide. The graves are in tiers on the sides, and when undisturbed are found closed with marble slabs or tiles, on which are often inscriptions or Christian emblems. It has been estimated that the entire length of the catacombs is not less than five hundred and eighty miles, and that they contain not less than six million bodies. From being the refuge of persecuted Christians, they became, about the thirteenth century, the hiding places of outlaws and assassins, who were, however, finally driven out or



LOCH KATRINE.

the entrances to their retreats closed. Many interesting and valuable books have been written on the catacombs, and some have spent a lifetime in investigating these wonderful caverns.

Loch Katrine.—Of all the Scottish lakes, so famous in song and story, none is so widely celebrated as Loch Katrine, which is situated near the southwest border of Perthshire. It is eight miles in length, and three-quarters of a mile in mean breadth. Its greatest depth is seventy-eight

fathoms, and its height above the sea about three hundred and seventy feet. Its shape is serpentine, and displays great variety of shore and background. Ben Venue and Ben An are on its banks. It contains several islets, one of which, Ellen's Isle, is the center of the action of the "Lady of the Lake." Several also of Wordsworth's lyrics were written on subjects suggested in this locality. The waters of the lake are remarkably pure, and it forms the water supply of the city of Glasgow.

Edinburgh Castle.—No city in the world is more picturesque than Edinburgh. Its site and structure combine to make it unique. It is a city of hills and valleys. When you are there everybody talks of the castle.



EDINBURGH CASTLE.

You cannot forget it if you would, for it dominates everything and is the heart of everything. Castle Rock, as the site of the Castle is called, is some seven hundred feet in circumference, and on three sides it is just bare rock, so precipitous that foot of man could hardly scale it. Accessible only on one side, a place more perfectly adapted for a fortress can scarcely be imagined. The old gray Castle itself is one of the most picturesque of buildings. Whether you see it at sunrise, at high noon, in the tender twilight time, or when the pale moon visits it, it is alike beautiful; but the most impressive view is obtained at sunset, when the valley is in shadow, the glow of the setting sun resting on the old gray Castle, making its windows flame like opals.

Melrose Abbey.—Melrose is a pleasant village at the foot of the Eildon Hills, on the south bank of the Tweed. It is famous for the ruins of its noble Cistercian Abbey, founded by King David I, in 1136. The original pile having been destroyed during the wars of the Succession, the monastery began to be rebuilt about 1326. The work was helped by large grants from King Robert Bruce and his son, King David II, but proceeded so slowly that it was scarcely finished at the Reformation, in the middle of



MELROSE ABBEY.

the sixteenth century. It was in the Second Pointed style, with one or two approaches to Third Pointed, and was beyond doubt the most beautiful structure of which Scotland could boast in the middle ages. What now remains are the chief portions of the conventional church, measuring two hundred and fifty-one feet in length, and some fragments of the cloister, which would seem to have been a square one hundred and fifty feet deep. The tracery and carvings are scarcely surpassed by any in England,

Alpine Peaks.—The famous Alps, the most extensive system of lofty mountains in Europe, raise their giant masses on a basis of ninety thousand square miles. They extend over the greater portion of Switzerland, and into France, Italy, Austria and Bavaria. The highest peaks are Mont Blanc, fifteen thousand seven hundred and forty-four feet; Monte Rosa, fifteen thousand one hundred and fifty-one feet, and Mont Cervin, fourteen thou-



ALPINE PEAKS.

sand eight hundred and thirty-six feet. The summits of these mountains are covered with perpetual snow. In the lowlands of the Alpine region there are many beautiful lakes and rivers. The scenery is wild and impressive, and thousands of travelers annually sojourn in the beautiful Swiss villages. Not the least charm of the locality is the picturesque life of the herdsmen and farmers, who ply their vocations amid scenes possessing a grandeur and beauty such as no artist has succeeded in faithfully portraying.

Paris.—"I know no walks in the world so fascinating," writes Louise Chandler Moulton, "as a ramble through the Garden of the Tuileries, across the Place de la Concorde, and on into the Champs Elysees. I have taken this walk as a soft spring day was drawing to its close. The sky was all rose and gold, and the distanees were softly purple in the evening glow. There was a charm in the scene, half-pensive and altogether tender, which I can never put into words. But it is much gayer in the afternoon. All the little out-door theatres are in full blast then, and there are several of them in the Garden of the Tuileries, and several more in the Champs Elysees. These theatres are for the children, and the performers are not people, but marionettes, or puppets. There is the merry-go-round, too, with its funny little wooden ponies, and its queer little ehariots, and the great strong Norman horses drawing the whole thing. How it earries me back to a summer



GARDEN OF THE TUILERIES, PARIS.

night at Etretat, and a crowd of peasants daneing a slow, fantastic dance in the pale and fitful moonlight, and pausing now and then to take a turn in just such a merry-go-round as this. I think I prefer the Garden of the Tuileries and the Champs Elysees to the Bois de Boulogne; and yet when I am in the Bois, I think I prefer that to anything else. It is so bright and gay, this place which was a noble forest till most of the trees were cut down in the evil days of 1870 and '71. But still it is one of the finest parks in the world, and between three and four in the afternoon you may see there the fashion and beauty of Paris. There are two artificia! lakes in the Bois, one two-thirds and the other a quarter of a mile in length. In the largest of these lakes are two islands, and on one of them is a cafe, in the form of a

Swiss chalet. You are taken from the mainland to this picturesque cafe for four cents, and you find there all sorts of dainty temptations in the way of eating and drinking. At one end of the Bois de Boulogne is an enclosed portion called the Jardin d'Acclimatation, a garden the purpose of which is to acclimatize in France birds, animals and plants from every quarter of the globe. The varieties of dogs alone seem endless, and as for birds, I had never dreamed of anything so various and so beautiful as this collection. There is a monkey-house, and there are carriages for children to ride in, some drawn by ostriches, and others by zebras, and I know not how many strange animals. Also there are amiable elephants, on whose backs you

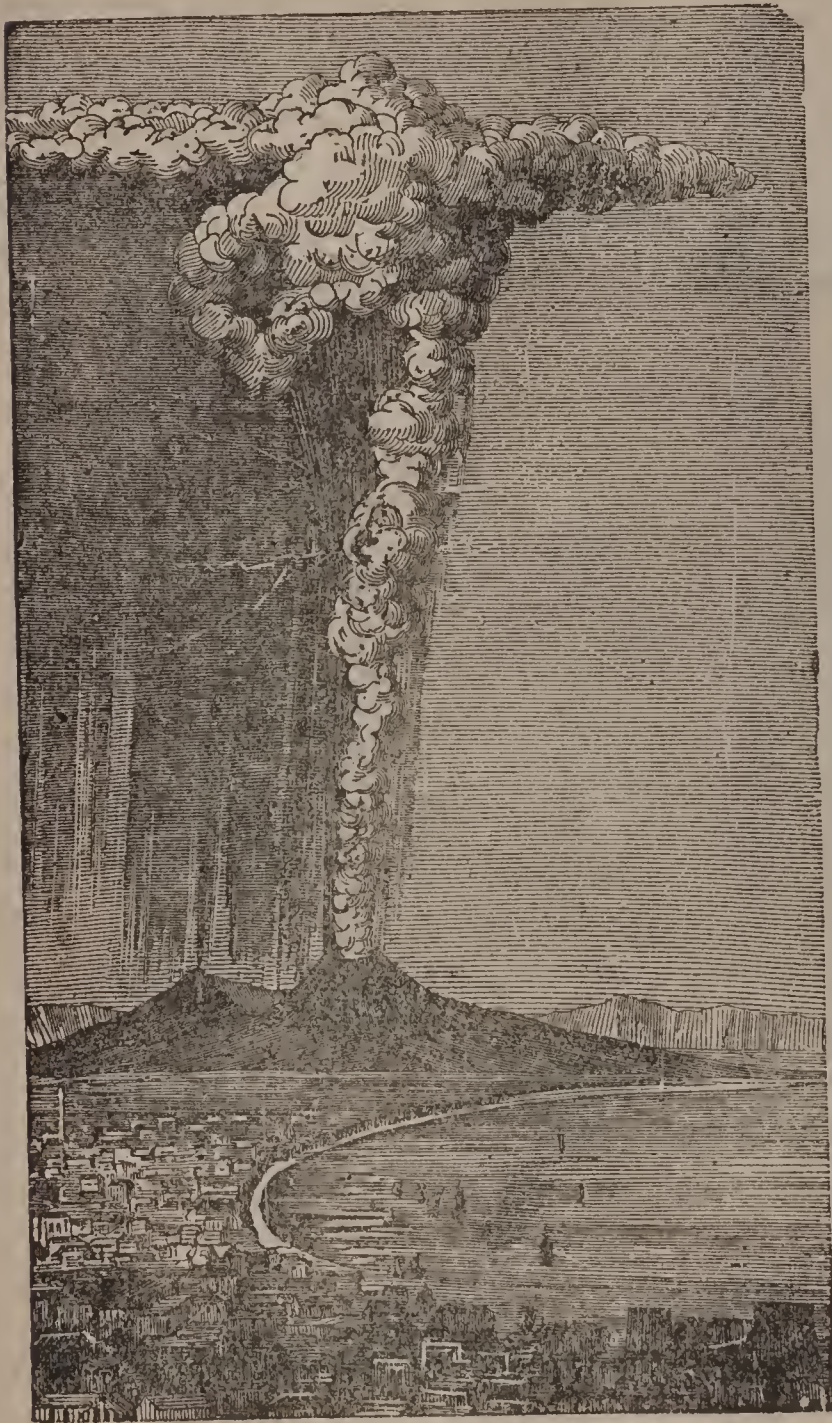


CHAMPS ELYSEES, PARIS.

may ride. It was a dream of delight to be there even to me, and I could fancy what it must be to the children. It is no wonder that they flock to it, since it would be impossible to conceive any spot on earth where more is combined to rejoice the wonder-loving, pleasure-loving heart of childhood."

Strasburg and Its Cathedral.—The eminent city of Strasburg, one of the most important towns in what travelers sometimes call French Germany, is built on an Island in the river Ill, which connects with the Rhine. Strasburg is a place of great wealth, and boasts of many learned and charitable institutions, and it has given to the world many eminent men in almost every department of knowledge. But the chief attraction of the city is its purely gothic cathedral, the great spire of which soars four hundred and sixty-eight feet in the air—the tallest spire in the world, and in altitude but

fourteen feet below the apex of the pyramid of Cheops. The towers and spire, as well as the body of the building, are of dark-red sandstone, which is found in abundance in the neighborhood. Although hemmed in by narrow streets, and tall houses, the Cathedral does not impress the reader with



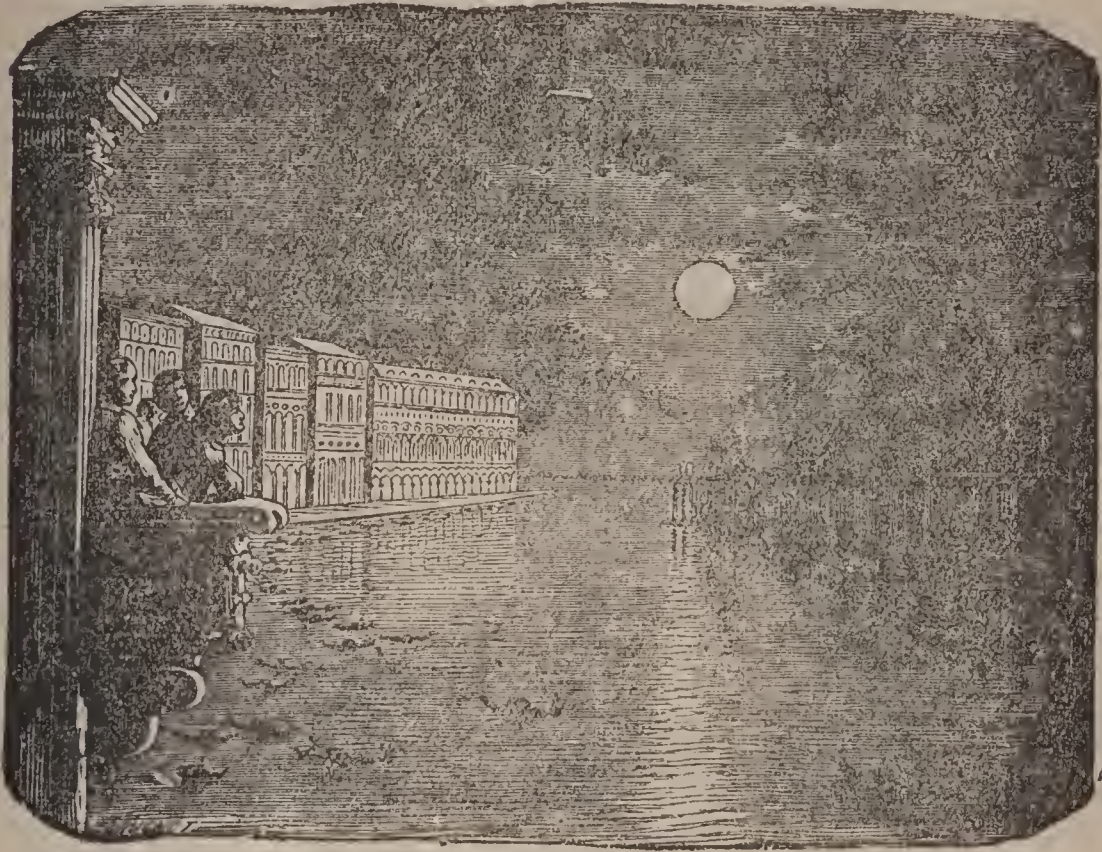
VESUVIUS IN ERUPTION.

heaviness, and the stonework of the spire is remarkable for the cleverness of its carvings, traceries and beauty of detail. The stone of the spire is cut rather to resemble iron castings or carved oak than chiseled stone. The whole is carefully tied together with iron rods, bars, clamps and bolts, so as to give it additional strength to resist the action of the wind. Should it ever fall, engineers and architects say it will be because of an earthquake. The western facade of the building is not completed as the architect designed it should be. He died a hundred years before the building was consecrated. Four centuries have elapsed since the tower was completed, and it looks as fresh as the day the capstone was put on it. The interior of the Strasbourg Cathedral corresponds to its exterior in finish and design. It is celebrated for its magnificent colored glass windows, which were made in the fourteenth and fifteenth centuries.

Vesuvius in Eruption.—Vesuvius is a celebrated volcano of Italy, six miles east of the city of Naples. It has two summits. Its perpendicular height is but three thousand seven hundred feet, though the ascent from the base to the summit comprises a distance of three Italian miles. One side of

the mountain is fertile and well cultivated, producing an abundance of vines; but the south and west sides are entirely covered with cinders and ashes, while a sulphurous smoke constantly issues from the top, sometimes attended with the most violent explosions, when huge stones and great masses of lava are emitted. The first eruption recorded in history took place in the year 79. In 1806 a violent eruption occurred, when a bright flame arose from the mountain top to the height of six hundred feet.

Venice.—Venice is a seaport city in Austrian Italy. The coast is a long and narrow belt of land, through a number of openings in which the waters of the Adriatic make their way between the mainland and the belt, and form a lagoon from twenty-five to thirty miles long and about five miles broad.



VENICE.

Into seventy-two little islands in this lagoon piles have been driven, and upon them Venice has been built, so that from any point of view the city seems to be floating on the water. The city is a little more than two miles long, one and a half broad, and about six in circuit. It is divided into two unequal parts by the Grand Canal, which runs through it in the form of an S reversed; and it is also traversed by one hundred and forty-six smaller canals. These canals are crossed by three hundred and sixty bridges; but over the Grand Canal there is but one—the Rialto. The Grand Canal varies in breadth, and on both sides is lined by magnificent buildings, many of them immediately on the water's edge, so that people step from them into the gondolas, of which there are said to be more than four thousand. The public buildings are splendid and numerous. There is but one Venice in all the world, and it is a city of enchantment. Imagine a great populous city where the rumble of wheels is never heard, and not a single horse is within its limits. All Venice is out of doors as soon as the sun has set.

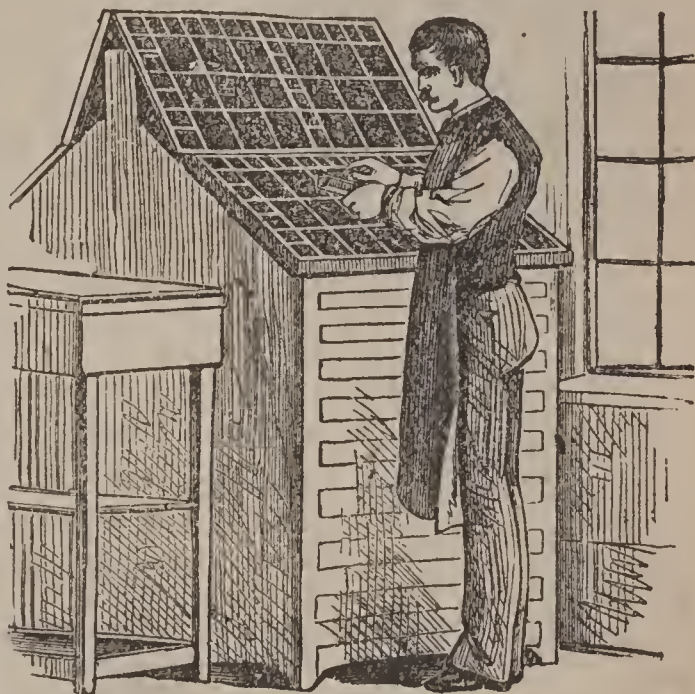
The Vatican.—The word is often used, but there are many who do not understand its import. The term refers to a collection of buildings on one of the seven hills of Rome, which covers a space of one thousand two hundred feet in length, and one thousand feet in breadth. It is built on the spot once occupied by the garden of the cruel Nero. It owes its origin to the Bishop of Rome, who, in the early part of the sixth century, erected an humble residence on its site. About the year 1160, Pope Eugenius rebuilt it on a magnificent scale. Innocent II, a few years afterward, gave it up as a lodging to Peter II, King of Aragon. In 1305 Clement V, at the instigation of the King of France, removed the Papal See from Rome to Avignon, where the Vatican remained in a condition of obscurity and neglect for more than seventy years. But soon after the return of the Pontifical Court to Rome, an event which had been so earnestly prayed for by poor Petrarch, and which finally took place in 1376, the Vatican was put in a state of repair, again enlarged, and it was thenceforward considered as the regular palace and residence of the popes, who, one after the other, added fresh buildings to it, and gradually encircled it with antiquities, statues, pictures, and books, until it became the richest depository in the world. The library of the Vatican was commenced one thousand four hundred years ago. It contains forty thousand manuscripts, among which are some by Pliny, St. Thomas, St. Charles Borromeo, and many Hebrew, Syrian, Arabian, and Armenian Bibles. The whole of the immense buildings composing the Vatican is filled with statues found beneath the ruins of ancient Rome, with paintings by the masters, and with curious medals and antiquities of almost every description. When it is known that there have been exhumed more than seventy thousand statues from the ruined temples and palaces of Rome, the reader can form some idea of the richness of the Vatican.

Vienna.—The capital of the Austrian Empire stands on a plain at the foot of the last hills of the *Wiener Wald*, which forms the eastern extremity of the Alps. East of it extends a vast plain, as far as the eye can see, away to the Carpathians, which are visible on a clear day in the distance. An arm of the Danube (called a canal) yasses along the northeast side of the city, and separates it from the suburb of Leopoldstadt. Into this arm flows the stream called the Wien, from which the city takes its name. Vienna consists of the old city or inner town, called the *Stadt*, with narrow and irregular streets, and of a circle of suburbs, nine in number, completely surrounding it. Around the *Stadt*, and separating it from the suburbs, is a ring space upon which were formerly the fortifications, leveled in 1858. This space is now being rapidly covered with buildings, of which the principal form part of the Ringstrasse, a handsome boulevard, in many places seventy yards wide. Unlike most other European cities, the old part of the city is the most fashionable. In the *Stadt* are the palaces of the emperor and of some of the principal nobility, many stately mansions, the public offices, the finest churches, most of the museums and public collections, the colleges, the exchange, and the best stores. The suburbs are laid out in wide streets, many of which, being unpaved, are extremely dusty in summer and very muddy in winter. As a rule, the houses are let in "flats," almost the only exception to this being the palaces of the higher nobility; and in some cases even these consist only of the two lower stories of the building. Among the principal squares are the *Josephsplatz* and the *Burghof* (the latter the court of the palace), the outer *Burgplatz*, in which stands the *Burghor*, the *Neuer Markt*, *am Hof*, and *Freiung*.

USEFUL ARTS AND MANUFACTURES.

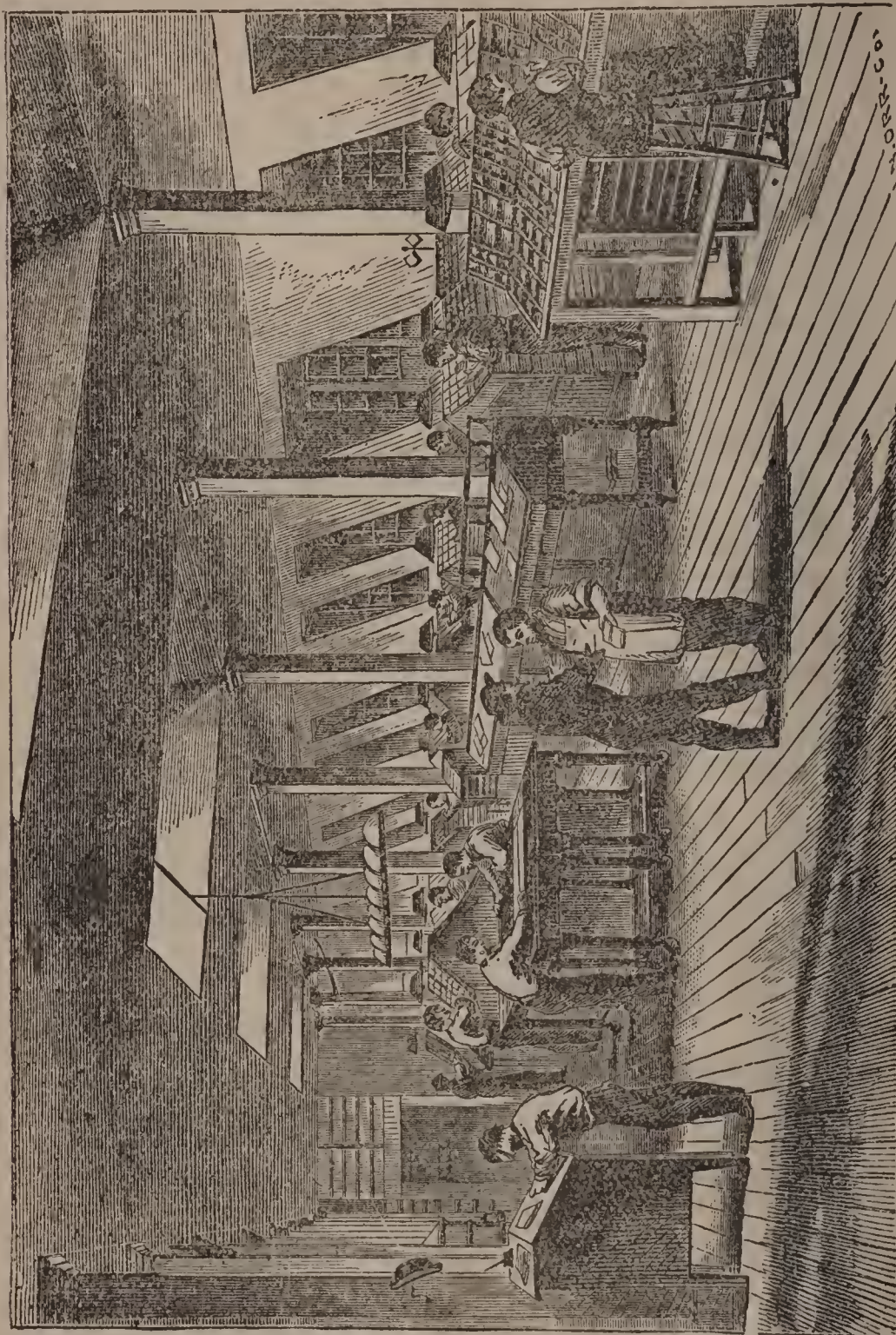
Printing.—The art of printing from movable types is of comparatively modern origin, only four hundred years having elapsed since the first book printed in this manner was issued from the press. The ancients printed from engraved blocks, and this method is preserved by the Chinese to this day. The credit of discovering the simple yet marvelous art of printing from movable types is contested by the Dutch in favor of Lawrence Coster, between 1420 and 1426, and by the Germans on behalf of Johann Gutenberg. The types first employed were of wood, but soon the practice of casting them in metal was introduced. Gutenberg succeeded in printing a Bible between 1450 and 1455.

All the types used in printing offices are sorted in cases, or shallow boxes, with divisions. These are of two kinds—the *upper* and *lower* case, the latter lying nearest to the compositor. In the upper case are placed all the capitals, small capitals, accented letters, a few of the points, and characters used as references. In the lower case are all the small letters, figures, the remainder of the points and spaces to place between the words. In the lower, no alphabetical arrangement is preserved; each letter has a larger or smaller box allotted to it according as it is more or less frequently required, and all those letters most in request are placed at the nearest convenient distance to the compositor. Placing the copy or manuscript before him on the upper case, and standing in front of the lower case, the compositor holds in his left hand a little iron tray called a *composing stick*. One by one he lifts and puts the letters of each word and sentence, and the appropriate points and spaces, into his stick, securing each with the thumb of his left hand, and placing them side by side from left to right along the line. On reaching the end of a line he rearranges the spaces, so as to make it exactly full and secure a uniform separation of the words. When the workman has set up as many lines as his stick will hold, he lifts them out and places them upon an



COMPOSITOR AT WORK.

elongated tray called a *galley*, and when the galley is full an impression or *proof* of the types is taken, which goes to the proof-reader, whose duty it is to mark upon the margins thereof such errors as may have been made by the compositor. After these have been corrected, the matter is divided

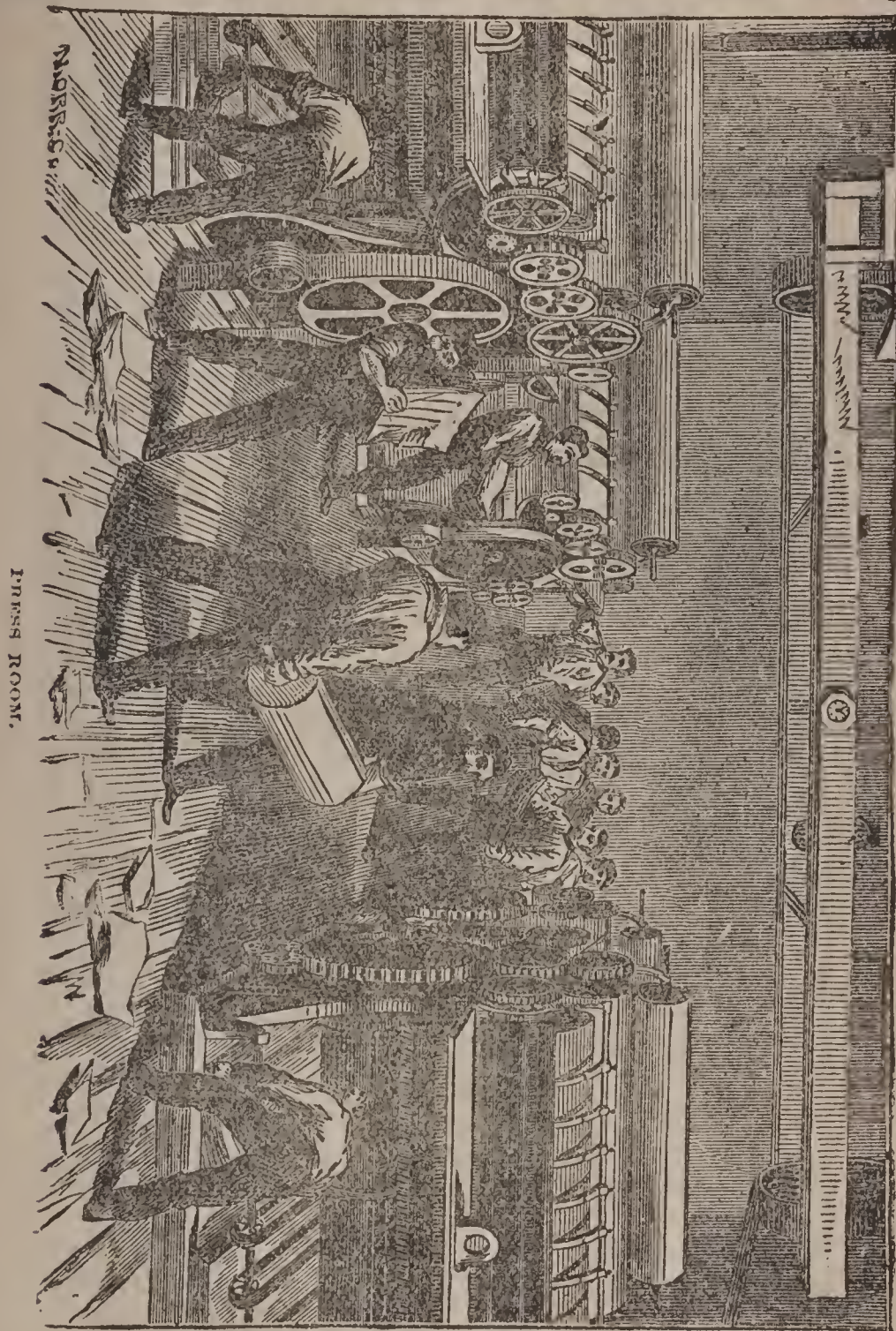


COMPOSING ROOM.

into pages of the desired size, head-lines and numerals are added, the pages are secured in an iron frame or *chase*, and, after the matter is again carefully read and corrected, the *form* is ready for the pressman or electrotyper, as the case may be.

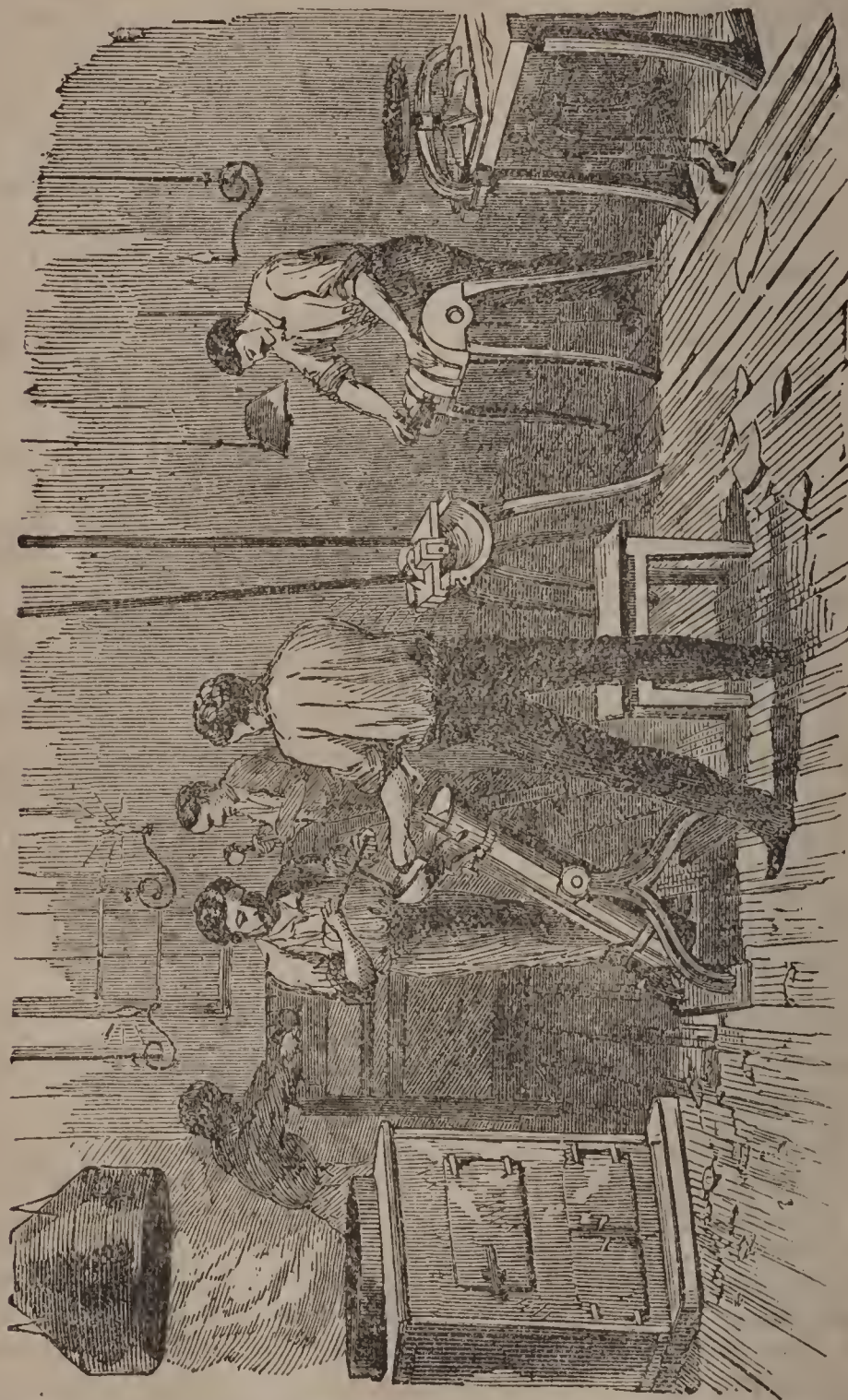
In no department of human industry has there been a more signal ad-

vancement than in the manufacture of the printing press, and the improved newspaper press of the present day would seem to be well-nigh perfect. To attempt a description of the many and various kinds of presses in use for the different styles of printing would be quite impossible within the limits allotted to this article, but the operation of a modern newspaper



printing machine may be thus briefly described: A reel of tightly-rolled paper, just as it leaves the mill, is placed at one end of the machine, is damped while passing between small cylinders, and is then led between the first and second of four cylinders, placed one above the other, where it receives its first impression from the stereotype cast of the first cylinder. The

paper then returns backward between the second and third cylinders; and passing forward again between the third and fourth, receives on its other side the second impression from the stereotype plates of the lowest cylinder. The roll is next cut into sheets, and the sheets numbered by an index. Carried up to the top of the machine, the sheet descends perpendicularly,



STEREOTYPING.

and is thrown alternately backwards and forwards on to boards held by two lads. These, with the striker, who starts the machine, are the sole attendants necessary. The paper travels at the rate of one thousand feet per minute, and the finished sheets are delivered at the rate of twelve thousand copies and upwards per hour.

Stereotyping.—The art of fabricating metal plates resembling pages of type, from which impressions may be taken as in letter-press printing, is termed stereotyping. This process is not employed where only a definite and moderate number of impressions of any work are required. Its chief value consists in its availableness for future impressions contingent on the renewed demand for copies; but it is also of importance in duplicating the means of taking large impressions quickly. Briefly the process is as follows: The page of type is laid on a smooth iron table, face upward; a little fine oil is brushed over it, to prevent the liquid stucco from adhering; the stucco to the consistency of cream is now poured over the face of the page, and straightened over it in the process of hardening; when hardened, the cake of stucco is lifted off, and is seen to be a perfect mold of the types. The cake is now baked in an oven, and then placed in an iron pan; the pan, which has inlets at the upper side, is plunged into molten metal, which soon runs into the mold; being lifted out and cooled, the pan is opened and found to contain a plate resembling the page of type; the mold is broken and of no further use. When removed from the pan, the plate is rough, and needs to be trimmed for working; for this purpose, it passes through the hands of artisans, who prepare it for the press. The *paper mache* process, wherein the mold is made of damp paper, is much quicker than the above, and is that in use in daily newspaper offices. In electrotyping the mold is taken in wax, coated with plumbago, and into this a film of copper is precipitated by a battery. The face of an electrotpe is therefore of copper, and it is much more durable than the stereotype.



SEWING BOOKS.

Bookbinding.—The first operation in bookbinding is to fold the sheets, by means of a small instrument called a folder. The object is to fold down the different pages so as to fall on one another; and on the perfect accuracy with which this is performed depends the proper binding of the book. After being folded, the sheets of the book are gathered and collated according to the "signatures," A, B, etc., which are printed at the bottom of the first page of each sheet. The books so made up and completed, are now pressed to a proper solidity, by being placed in quantities in a hydraulic press. The next process is to saw indentations in the back of the book, preparatory to sewing. The books are next sewed on a frame, each sheet being attached by a thread to cords across the back. The sewing, though sometimes done by a machine, is chiefly executed by girls. On being removed from the sewing-frame, the book receives its "waste-papers," which are pasted to the

back on each side. The book is now "trimmed," by being cut on the edges with a knife-apparatus. The books are next glued on the back, to impart a certain degree of firmness. After this, they are "backed" by means of a machine, which imparts a certain roundness to the back, and at the same time gives a seat for the boards. The book, with a slip of canvas pasted on the back, is now ready for receiving the boards, which are previously cut in large quantities by a machine. The preparing and attaching of the cover forms the final stage of the process. For the whole of the class of boarded books we have been describing, there is a method of making "cases." A case consists of cloth or paper pasted on two boards, the distance of the boards from each other being equal to the thickness of the book. The case being finished, receives the book, to which it is attached chiefly by pasting it to the canvas of the back and the blank or waste paper on each side. When it is deemed necessary, for the sake of attractiveness, to stamp a peculiar device on the covers of a book, of which thousands are required, the design is referred to an artist, who, devoting himself to this branch of his profession, devises something appropriate and original. His design, drawn on paper, is cut in brass or steel; and this, in the form of a metal block,

gives the stamp at a blow by the arming-press. When the design is to be gilt, leaf-gold is previously applied.



WOOD ENGRAVING.

Wood Engraving.--The wood used for engraving is boxwood, nearly all of which is imported from Turkey. It is

cut across the grain in slices, which are dressed to the same height as type, for convenience in printing. When *blocks*—as the pieces of wood are termed—are required of a larger size than a few inches square, it is necessary to join two or more pieces together, as the amount of sound wood to be got out of even a large slice is extremely limited. There is, however, for all practical purposes, no limit to the joining process, as blocks have been printed consisting of from fifty to one hundred pieces. The wood having been made very smooth on the surface, and squared to the required size, is prepared for the artist by being covered with a preparation of white (commonly water-color Chinese white); this gives a very good surface for the pencil to work on. The subject is then drawn in the ordinary way, the tints being generally washed in with India-ink, and the details filled in with pencil. When the drawing is finished, it is given to the engraver, who, previous to commencing, carefully covers the block with paper, fastened round the edges with beeswax; this is necessary, to avoid rubbing the drawing out in the process. As the engraving proceeds, he gradually tears the paper off. The tools or gravers necessary in wood engraving are of three kinds—viz., gravers proper, tint-tools, and scoopers or cutting out tools, for clearing out

the larger pieces. They are arranged in different sizes, to suit the different portions of the work. Most engravers use a glass of slight magnifying power, more for the purpose of relieving the eyes from the strain of fixing both eyes closely on a small object, than for magnifying the work. When the drawing is in outline, or mostly so, the engraving is very simple: the process consists of engraving a line along each side of the pencil lines, which are, of course, to be left in relief, and afterwards cutting out the pieces between. It will thus be understood that every part of a wood-cut which prints on the paper is the surface of the wood left untouched, and that every white part is cut or hollowed out. When it is complicated with much shading, trees, etc., it becomes much more difficult, and brings into play the artistic talents of the engraver to preserve the proper shades, or *color* as it is technically termed, and texture of the different objects.

Copper - Plate Printing.

—In all engraving upon metal plates the traces or marks which are to appear on the paper are cut or sunk into the plate. Copper-plates are ready for press as soon as they are finished by the engraver. The method of printing from them is very simple. Their engraved surface is daubed over with a thick oleaginous ink, so that the lines are effectually



COPPER-PLATE PRINTING.

filled. As this dirties the whole face of the plate, it is necessary to clean it, which is done by the workman wiping it first with a piece of cloth, and then with the palms of his hands, rubbed on fine whiting. It may be calculated that a hundred times more ink is thus removed than actually remains in the indentations; however, such is necessary. The plate being thoroughly cleaned, it is laid on a press with a piece of dampened paper over it; and being wound beneath a roller covered with blanket-stuff, it is forced to yield an impression on the paper. The plate requires to be kept at a moderate warmth during the operation.

Lithography.—The art of printing from stone was invented by Aloys Senefelder, at Munich, about the end of the 18th century. It consists, first, in writing and drawing on the stone with the pen and brush, with the graver, and with the crayon or chalk, or in transferring to the stone writings and drawings made with the pen or brush on transfer paper, or impressions from copper, steel, and pewter plates, taken on a coated paper, and then in

printing off from the stone the writings or drawings thus made upon it. The principles of the art are these: An unctuous composition having been made to adhere to a calcareo-argillaceous stone, those parts covered by it—*i. e.*, the writing or drawing—acquire the power of receiving printing ink, whereas those parts not containing the writing or drawing are prevented from receiving ink from the inking roller by the interposition of water; and lastly, an absorbent paper being laid on the stone, and subjected to strong pressure, copies are obtained. When any writing or drawing has been finished on stone, it then requires to be etched, thus: a mixture of two parts of nitric acid, and from forty to sixty parts of dissolved gum arabic, is poured over the stone once or several times, according to the nature of the work. The etching changes the surface of the stone, raising the work on it to a degree scarcely perceptible to the naked eye. The writing or drawing, which has been effected by greasy ink or chalk, remains protected from the action of the acid, and those protected parts retain the natural property of the stone, which is the qualification of receiving printing ink; and, when the printer wets the stone before applying the inking roller, the water enters only those parts of the stone which have been affected by the acid, while the ink adheres only to those parts, however fine, on which the acid could not operate, owing to the unctuous composition of the ink or chalk with which the drawing or writing has been done, and which, being greasy, rejects the water. When the *drawing or writing with ink* on a polished stone is completed, the etching is proceeded with, and a portion of the etching composition allowed to dry on the stone. The printer then adjusts his stone in the press, washes off the dried gum, removes the whole drawing or writing with turpentine, wets the stone with a sponge or damping canvas, then applies his roller containing the printing ink, and rolls it several times over the stone till the lines appear again. When sufficient ink has been applied to the lines, the paper is laid on the stone, drawn through the press, and the impression effected. The damping and inking of the stone are renewed for every impression. Tinted drawings, chromo-lithography and colored maps require as many stones as there are various tints or colors, one stone being printed after the other, and so fitted and blended together as to produce, when complete, the effect desired.

Photography.—The honor of having been the first to produce pictures by the action of light on a sensitive surface is now very generally conceded to Thomas Wedgwood, an account of whose researches was published in 1802 in the “Journal of the Royal Institution,” under the title, “An Account of a Method of Copying Paintings upon Glass, and of making Profiles by the Agency of Light upon Nitrate of Silver; with Observations by H. Davy.” In the experiments detailed in this communication, white paper and *white leather* were imbued with nitrate of silver, and exposed either in the camera obscura, or under the leaves of trees or wings of insects. The result was, that the shadows preserved the parts concealed by them white, while the other parts became speedily darkened. The misfortune was, that no attempts made either by Wedgwood or Davy to prevent the uncolored portions from being acted on by light (or, as we now say, to *fix* the picture), were successful. This operation was not effected in a thoroughly efficient manner until Sir John Herschel suggested the employment of hyposulphite of soda for that purpose. Many other fixing agents had been previously used, as ammonia, iodide of potassium, chloride of sodium, and bromide of potassium, suggested by Mr. Fox Talbot; none of these, however, were

found equal to the salt proposed and successfully used by Sir John Herschel.

M. Niepce, of Chalon-on-the-Saone, was the first to enjoy the satisfaction of producing *permanent* pictures by the influence of solar radiations. This was accomplished in 1814, and the name chosen to designate his process was heliography—a name in some respects preferable to photography. It consisted in coating a piece of plated silver or glass with a varnish made by dissolving powdered asphaltum to saturation in oil of lavender, taking care that the drying and setting of this varnish be allowed to take place in the entire absence of light and moisture. The plate so prepared was then exposed in the camera obscura for a length of time, varying from four to six hours, according to the amount of light. A faint image only is at first visible, and this is afterward developed and fixed by immersion in a mixture of oil of lavender and oil of white petroleum; the plate being finally washed with water, and dried. Light has little or no action on these heliographs; they should, however, be protected from moisture. M. Daguerre improved on this process, by suggesting the use of the resins obtained by evaporating oil of lavender, whereby a great increase of sensibility was secured.

Adopting date of publication as the best evidence of discovery, the next process offering itself for consideration is that for photogenic drawing by Mr. Henry Fox Talbot, communicated to the Royal Society on the 31st January, 1839, just six months previous to the publication of Daguerre's process. It consisted in immersing carefully selected writing paper in a weak solution of common salt, and drying it. After this a dilute solution of nitrate of silver was spread over one side, and the paper again dried at the fire. When dry, it was fit for use, the sensitiveness being much increased by alternate treatment with saline and argentine solutions. Paper thus prepared yielded impressions in an incredibly short time, and nothing could be more perfect than the images it gave of leaves and flowers, the light passing through the leaves delineating every ramification of their nerves. Considerable improvement in point of sensibility was attained by Mr. Talbot in the following year, 1840, by the employment of iodide of silver on paper, as a foundation, to be washed over with a mixture of aceto-nitrate and gallo-nitrate of silver, just previous to exposure in the camera. Paper so prepared was so sensitive that an exposure of less than a second to diffused light was enough to produce an impression. After exposure and development, the picture was washed, and fixed by immersion in a solution of bromide of potassium.

Niepce and Daguerre accidentally discovered that they were conducting experiments of a kindred character, and shortly afterward entered into a partnership. The former, however, dying in July, 1833, a new deed of partnership was signed between his son Isidore and M. Daguerre, which resulted in the publication, in July, 1839, of the process known as the Daguerreotype. This was not done, however, until the French government had passed a bill, securing to M. Daguerre a pension of six thousand francs, and to M. Isidore Niepce, the son of *the* Niepce, a pension of four thousand francs, both for life, and one-half in reversion to their widows. This handsome conduct on the part of the French government was based upon the argument, that "the invention did not admit of being secured by patent, since, as soon as published, all might avail themselves of its advantages;" they, therefore, chose to enjoy "the glory of endowing the world of science and of art with one of the most surprising discoveries that honor their native land."

The discovery of the Daguerreotype may be said to have arisen from the

dissatisfaction entertained by Daguerre with the insensibility of the bituminous surfaces of Niepce, which induced him to turn his attention to the salts of silver as a means of producing a higher degree of sensitiveness. This he attained by exposing a highly polished plate of silver (attached for greater strength, to a copper plate) to the vapor of iodine, by which pure iodide of silver was formed on the surface. The plate so prepared was exposed in the camera obscura for a length of time (twenty minutes), which was then considered very short. No *apparent* effect was produced on the plate, the image being a latent one, arising from a minute molecular disturbance caused by the impact of the actinic rays. The latent image was afterward *developed* by exposing the plate to the vapor of mercury; and it is this development of a *latent* image, reducing as it did the time of exposure from hours to minutes, which truly constituted a new era in the science of photography. It is further due to Daguerre to state, that, while his processes for the purpose were imperfect, he still succeeded in fixing his pictures, although it was reserved for Sir John Herschel to announce the great suitability of the hyposulphites for dissolving the haloid salts of silver. The sensibility of the silver plate was still further increased by Mr. Goddard, who suggested, in 1839, the association of the vapor of bromine with that of iodine; while M. Claudet, in 1840, employed chlorine. It is a remarkable fact in connection with these discoveries, that the elder Niepce should, so early as 1820, have tried the treatment of silver plates with the vapor of sulphur and phosphorus.

But the progress of this interesting science received a very important impulse from a discovery, which at first scarcely appeared to have any connection therewith. In 1833, Braconnot gave, in the "*Annales de Chimie*," an account of a new substance obtained by the action of nitric acid on starch, sawdust, linen and *cotton-wool*. He named this substance Xyloidine; it was very combustible, and burned almost without residue. In 1838, Pelouze, in the "*Comptes Rendues*," suggested its application in artillery. He says, "Plunge paper in nitric acid (specific gravity 1.500), leave it in for two or three minutes, and wash: a kind of parchment is obtained, impermeable to moisture, and extremely combustible." Dumas, in 1843, proposed the name Nitramidine, and suggested its use for fireworks. At a meeting of the British Association held at Southampton in the year 1846, Herr Schonbein, an eminent Prussian chemist, read a paper on the preparation of explosive cotton, a substance obtained by acting on ordinary carded cotton by a mixture of strong nitric and sulphuric acids. This explosive cotton was afterward found to be soluble in ether; and the solution so prepared was named collodion by its discoverer, Mr. Maynard, who, in 1848, published in the "*American Journal of Medical Science*" the formula for its preparation. This ethereal solution having a certain proportion of alkaline iodides and iodide of silver added thereto, constituted the collodion first employed by Mr. Archer, who, although deserving the credit of having first arranged a practicable working process with collodion for its basis, without which photography could not have attained its present high position, says, in the second edition of his "*Manual*," "It is due to Le Gray to say that he was the first to publish an account of collodion as a photographic agent;" thus illustrating the candor with which Mr. Archer admitted his claim to be considered the first to suggest its value in photography. Mr. Fallon Horn and Mr. Frye materially assisted Mr. Archer in bringing his experiments to perfection. Although the announcement at the British Association in 1846, was to the effect that Schonbein had made cotton as explosive as gunpowder,

no particulars were published. In April, 1847, he obtained a patent; but in October, 1846, Mr. Thomas Taylor had published a similar method to that patented. By one of those singular freaks of fortune which sometimes occur, Daguerre succeeded in identifying his name with his process; but Mr. Archer was not so fortunate as to give his name to the process which he invented. The sensitive surface is obtained by the conversion of the soluble iodides and bromides in the collodion film into iodide and bromide of silver by immersion in a solution of the nitrate of that base, and it is exposed in the camera while still moist with adherent nitrate, the *latent* image so obtained being *developed* with a mixture of protosulphate of iron, acetic acid, and alcohol, *fixed* with hyposulphite or soda, and varnished.

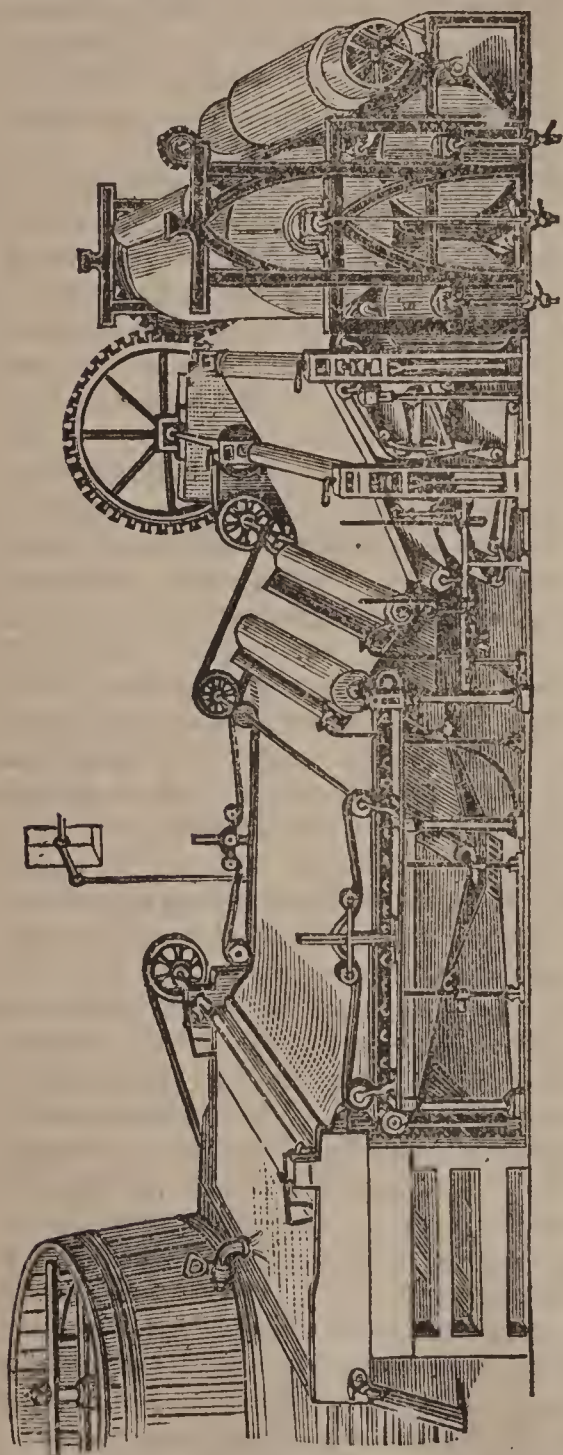
In the Niepco type or albumen process, glass plates of proper thickness and quality, and perfectly clean, are coated with albumen, to which an alkaline iodide has been added. When perfectly dry, they are immersed in a solution of nitrate of silver, when an immediate decomposition takes place; iodide of silver being formed in the albumen film, and nitrate of potash or ammonia remaining in solution. The plate is then freely washed with water, dried, exposed, developed with gallic acid, and fixed with hyposulphite of soda.

A retrospective glance will show the reader that four processes have now been passed in review; and on a little consideration, it will be seen that one *principle* pervades the whole—viz., the production of a *latent* image by the action of light on *iodide* and *bromide* of *silver*, its subsequent *development* by suitable means, and the final removal of the unaltered portions of the sensitive film by a *fixing* agent.

Among these processes, that in which collodion is employed has achieved a well-merited distinction, and is now so generally employed, as almost entirely to exclude the others. Various modifications of this process have been from time to time suggested to meet the exigencies of landscape photography. It has already been stated that the collodion film is exposed while still moist with adherent nitrate of silver solution; and this method is especially applicable to the taking of portraits, where it is desired to reduce the time of exposure to a minimum; but for landscape purposes, it is by no means so imperatively necessary to curtail the time of exposure; and as the necessary apparatus and materials for sensitizing and developing a wet plate are somewhat cumbrous for field work, it was suggested by the Abbe Despratz to wash off the free nitrate from the surface, and allow the film to dry in the absence of light. This is called the "Dry Collodion Process." A plate so prepared is, however, much less sensitive to light. A variety of agents have been used to preserve the film, such as sugar, albumen, malt, tannin, etc.

The practice of photography in the present day is confined almost exclusively to the Positive, the Negative, and the Dry Collodion Processes. The *first* and *second* differ only in degree, or density of deposit, the image being a *positive*—i. e., having its lights and shadows in their proper positions, when seen by reflected light; and a *negative*, or with its lights and shadows reversed, when examined by transmitted light. The positive is backed with black varnish, and the desired pearly-white deposit produced by development with the protonitrate and sulphate of iron, and nitric and acetic acids. The negative is used only as a *cliche* from which to print positive impressions on paper or other suitable material, and requires a greater degree of density, its high lights being quite opaque, and descending by delicate gradations to its deepest shadows, which should be represented by

clear glass. The negative requires a longer exposure in the camera than the positive, and is generally developed with protosulphate of iron and acetic acid, and intensified with pyrogallie and acetic acids, and nitrate of silver. The *third* or dry process is distinguished from the preceding modifications of the wet process by the complete removal of the adherent free nitrate of silver, the application of a preservative agent, and the necessity



PAPER-MAKING MACHINE.

for adding nitrate of silver to the developer. There has recently come into general use a modification of the dry process, which is likely to supersede all others. It is known as the collodio-bromide or emulsion process, and was introduced by Syce and Bolton of Liverpool in 1864, but attracted little attention till 1871. An emulsion is formed by the addition of bromide of cadmium, and nitrate of silver to collodion; this is poured on a plate, washed, and immersed in any of the preservative solutions, and may be exposed wet, or dried and kept indefinitely. Plates so prepared are very sensitive, and possess the great advantage of being capable of development without nitrate of silver; pyrogallie acid, ammonia and bromide of potass bringing them easily up to printing density.

Paper.—This well-known fabric is usually composed of vegetable fibres minutely divided and recombined in thin sheets, either by simple drying in contact, or with the addition of size or some other adhesive material. Whatever the material employed, the process is the same. The rags, bark fibres, or other substance, must be reduced with water into a fine, smooth pulp. The paper-making machine has almost entirely superseded the old hand process. It contains a pulp vat,

with a hog or wheel inside to agitate the pulp, and an arrangement for pouring the pulp over a wire-gauze mold, which is an endless sheet moving round two rollers, which keep it stretched out and revolving when in operation. Under the part which receives the pulp there is a series of small brass rollers; these, being nearly close together, keep it perfectly level,

which is a most necessary condition; besides which, there is a shallow trough, called the *save all*, which catches and retains the water, which always escapes with some pulp in suspension; and an arrangement of suction boxes and tubes, worked by air pumps, which draw much of the water out as the pulp passes over them. The pulp is kept from running over the sides by straps called the *deckles*, which are also endless bands, usually of vulcanized India-rubber, carried round moving rollers, so that they travel with the wire-gauze, and therefore offer no resistance to it. In addition to all this, the frame-work on which the surface of the wire-gauze rests has a shogging motion, or side-shake, which has an important effect in working the fibres together before the pulp finally settles down. When it reaches the *couching-rolls*, which press out most of the remaining moisture, and carry it forward to the first and second series of press-rolls by means of an endless web of felt which passes round them, the speed of these rollers and the traveling sheet of felt is nicely calculated, so as to prevent a strain upon the still very tender web of paper. Sometimes the upper rollers of these two series are filled with steam, in order to commence drying the web. The paper is now trusted to itself, and passes on from the second press-rolls to the first set of *drying cylinders*, where it again meets with a felt sheet, which keeps it in close contact with the drying cylinders, which are of large size, and filled with steam. Around these it passes, drying as it goes; is then received between the two *smoothing-rolls*, or damp calenders, which press both surfaces, and remove the marks of the wire and felt, which are until then visible on the paper. This is necessarily done before the drying is quite completed; and from the smoothing-rolls it passes to the second series of drying cylinders, where the drying is finished, and thence to the calenders, which are polished rollers of hard cast-iron, so adjusted as to give a considerable pressure to the paper, and at the same time a glossiness of surface. For writing-papers, the paper passes through a shallow trough of size after leaving the drying cylinders, and then passes over another series of skeleton cylinders, with fans moving inside, by which it is again dried without heat, and afterwards passes through the calenders. Printing and other papers are usually sized by mixing the size in the pulp, in which stage the coloring materials—such as ultramarine for the blue tint of foolscap—are also introduced. Still following the paper web, it is seen to pass from the calenders to another machine; this slits the web into widths, which are again cross cut into sheets, the size of which is regulated at will. The water-mark is impressed on machine-made paper by means of a fine light wire cylinder with a wire-woven pattern; this is placed over the wire-gauze sheet upon which the pulp is spread, but near the other end of it, so that the light impression of the marker may act upon the paper just when it ceases to be pulp, and this remains all through its course. There are many other interesting points about the paper-machine, but their introduction here would rather tend to confuse the reader. Its productive power is very great; it moves at a rate of from thirty to seventy feet per minute, spreading pulp, couching, drying, and calendering as it goes, so that the stream of pulp flowing in at one end is in two minutes passing out finished paper at the other. It has been computed that an ordinary machine, making webs of paper fifty-four inches wide, will turn out four miles a day.

Silk.—Silk is the produce of a little caterpillar, being the substance of which the cocoon is formed, in which it reposes during its chrysalis state.

All the insects which we call butterflies or moths, of which the silk worm

is one, pass through two stages of existence before they arrive at their perfect and final form; first, they are worms or caterpillars; then they pass into some sort of chrysalis, in which state the functions of life appear suspended; some of them bury in the earth, others make themselves cases of various materials in which to sleep till the time for their change comes; the silk-worm, at this time, spins itself a hollow oval ball of golden-colored silk. This period of sleep being past, the perfect insect emerges a beautiful butterfly, glittering in all the colors of the rainbow, and basking in the sunshine; or a soft and downy moth flitting through the evening shadows.

The moth of the silk-worm is a quiet grayish moth, with no beauty to recommend it, and not very active either, its sole business appearing to be to lay the eggs which are to furnish the next crop of useful spinners; these eggs are about the size of a grain of mustard-seed, and care is required in hot climates that they do not hatch before the time when their natural food is ready for them. In cold climates, there is no care of this kind necessary, as they need artificial heat to hatch them.

The silk-worm in a wild state feeds only on the leaves of the mulberry-tree, and though it will eat the lettuce and some other things, it never



THE SILK-WORM.

thrives; nor is it singular in this, for many other kinds of caterpillars are found only or chiefly on one tree or plant, which is their favorite food.

The eggs are hatched by artificial heat. The old plan for accomplishing this was for some person to wear them next their bosom for three or four days; but the present plan is to place them in a room the temperature of which is gradually raised, until the tenth day it reaches eighty-two degrees;

when the eggs turn whitish it is a sign they are nearly ready to be hatched; sheets of perforated paper or pieces of clear muslin are placed over the eggs, and the tiny worms as they come out of their shells climb through to the upper surface of the paper or muslin. Small twigs of mulberry are placed on the paper, and as the little nurslings climb on to these they are carried away to the rearing-house and other twigs are laid on. Great care is taken that the room in which the worms are kept should be well ventilated, and they are fed with young leaves chopped small. The silk-worms grow very rapidly; at first they are little black threads, small enough to be coiled in a shell not bigger than a mustard-seed. After one has grown for about eight days it refuses food, appears sickly, and pines, and in three days completely changes its skin, throwing off the old one which had confined it; it then grows rapidly again until the time of its second moulting, when it again refuses food, again casts off its skin, and increases very rapidly in bulk. This operation is repeated once more, and after the final moulting the worm is sometimes almost three inches long, and six will weigh an ounce; whereas when they were first hatched fifty thousand weighed no more.

Little artificial hedges of twigs are formed upon the shelves on which the worms have been fed, and when they are quite ready, and have no longer any inclination to eat, they climb among the twigs and seek a convenient place for forming their cocoons. They first spin thin, loose threads, and inside these they form a hollow ball, firm and elastic, and capable of being unraveled into one continuous thread, varying in length from three hundred to six hundred yards. The length of a cocoon is generally about one inch, and its width about two-thirds of an inch; this is measured without the external loose floss silk, which, with some part of the cocoon, can never be reeled off, but has to be spun in the same manner as cotton. The cocoons are either white or yellow, those which are the latter hue contain the most of a peculiar gum which stiffens the silk, and with which the worm smears the interior of its cell when finished, to render it both air and water tight. The emission of all this silk, which has been secreted in two spiral vessels contained in the stomach of the worm, greatly reduces its size, and when, at the end of three or four days, the cocoon is completed, it rests awhile; and then changes its last caterpillar skin for the chrysalidan form, and would, if undisturbed, emerge in about fifteen or twenty days a moth.

Usually the silk is taken in about seven or eight days from the time when the cocoons were finished. Great care must be taken to handle them gently, and to sort them very carefully, selecting some of the best to be preserved for the eggs. The perfect cocoons are put by themselves, and those which are soiled, double, or by any means imperfect, are sorted also. It is customary to kill the chrysalides in all those which are intended to be reeled, by exposure to great heat, and after this has been done the balls are stowed away on shelves in rooms intended for the purpose.

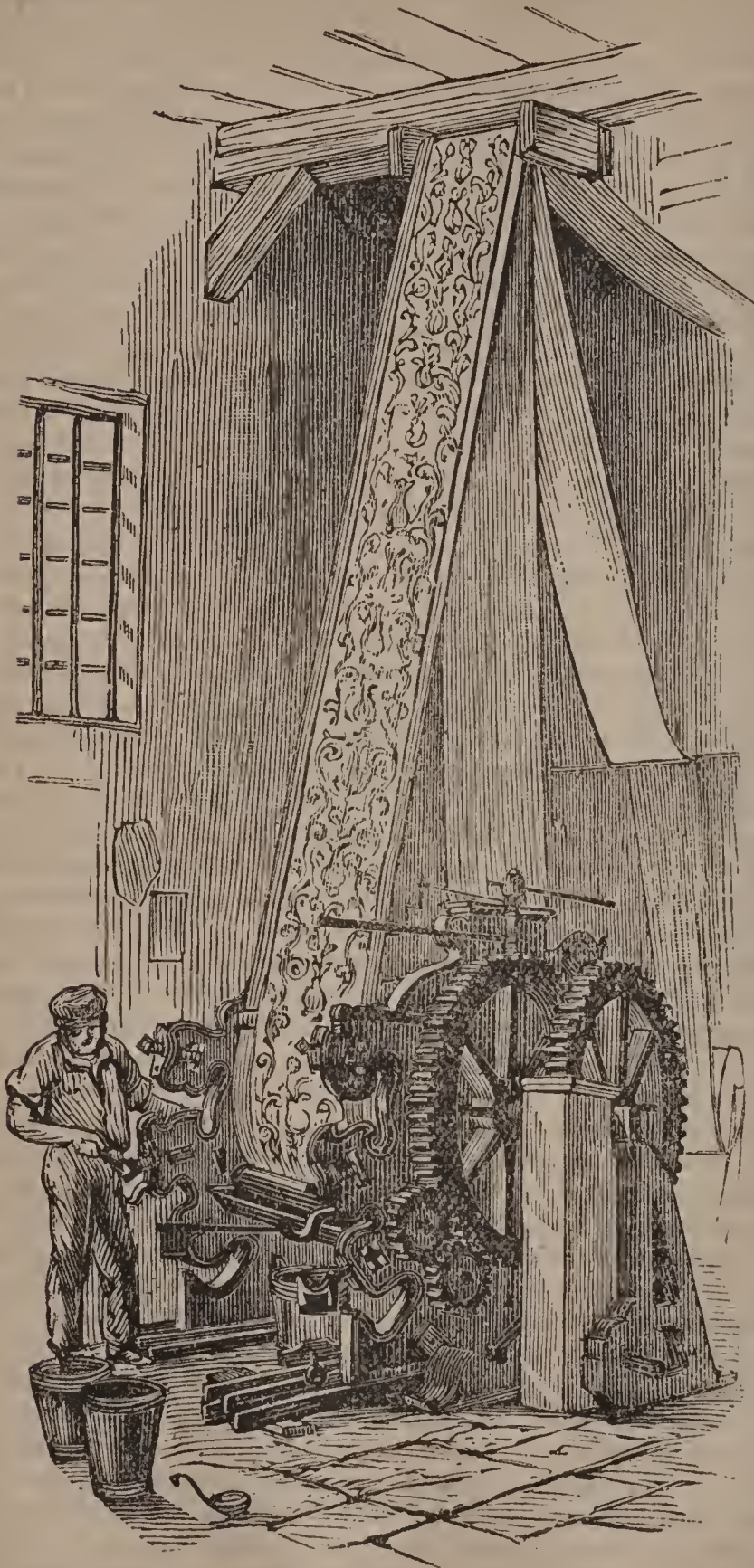
In the average not more than one pound of reeled silk can be obtained from twelve pounds of cocoons; some of the difference being occasioned by the weight of the chrysalis, and the remainder by the floss or refuse silk.

To reel the silk a little machine turned by hand is employed, which contains a large reel to form the skein of silk; this is usually about one yard in circumference, with a wheel which guides the thread to and fro in the same manner in which sewing-cotton is wound on reels. Attached to this is a small boiler, about eighteen inches long and six inches deep, under which a small charcoal fire is made; into this boiler the cocoons are thrown when the water is nearly boiling, and after a few minutes their gum is sufficiently softened for the loose filaments to float off. The reeler takes four or more of these in her hand, and twisting them together they adhere by means of the softened gum, and when attached to the reel, are wound off as one thread; by this means their strength is greatly increased. When the thread from one cocoon breaks it is not needful to tie a knot, the gumminess of the silk being sufficient to unite the ends; and great care must be taken by regulating the number of threads wound at once, that the thread produced be of uniform size throughout.

After reeling, the silk is sent to a mill where it is worked from raw silk into *singles*, *tram*, or *organzine*; singles is merely made by *twisting* the raw silk; for the formation of tram two or more threads are twisted together (this kind is used for shoot or weft); while organzine is a *real*, though fine, *cable* made of silk, it being composed of separate cords, each of which has previously been twisted; organzine is principally used for warp.

The silk thus thrown is called hard silk, and must be boiled with soap in order to discharge the gum; for unless this were done the silk would be harsh to the touch, and unfitted to receive the beautiful dyes which are

always given to silk before it is woven. The boiling, which lasts four or five hours, lessens the weight, but increases the bulk of the silk, and renders it soft and glossy.



CALICO PRINTING.

Calico Printing.--

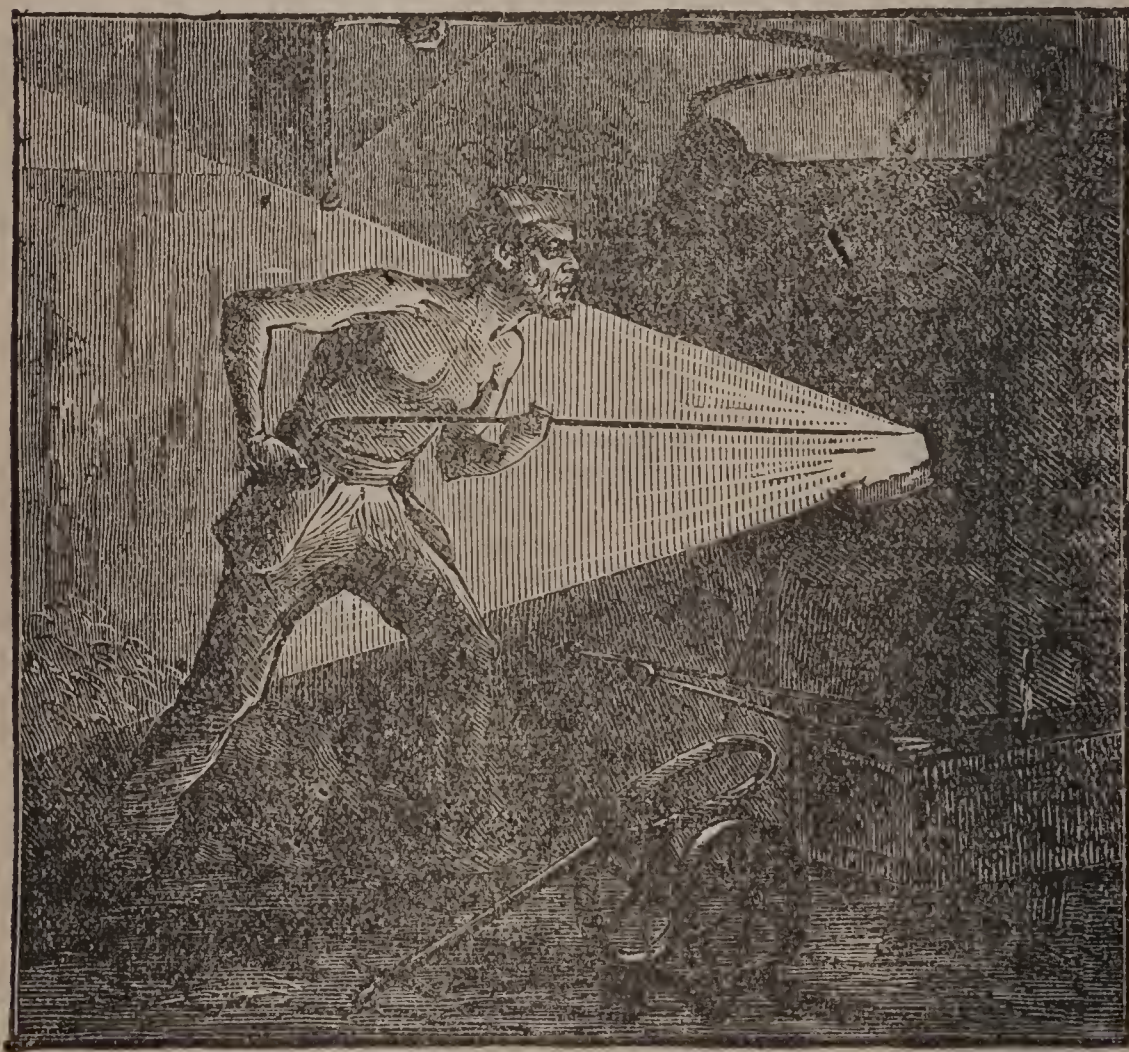
The first operation connected with the printing of cloth is the removal of the surface hairs or minute threads which communicate a fibrous down or nap to the surface of the cloth, and if allowed to remain, would interfere with the uniform application of the colors. The surface down is got rid of by the process of singeing, during which the cloth is drawn over a red-hot iron or copper bar or plate, or through a series of gas jets. When well singed the cloth undergoes the process of bleaching, and is thereafter calendered. There are several modes of applying the colors to cloth, but one of which, termed the *madder style*, we have space

to describe. The *madder style* is that in which a certain fixing agent or mor-

dant is printed on the cloth, which is then introduced into the coloring matter in a dye-vat, when the mordant, having an attraction alike for the fibre of the cloth and for the coloring matter, acts the part of glue or paste, and cements the color to the cloth. Originally, madder was the only coloring substance employed in this style; but now-a-days, by far the greater number of dye-stuffs, vegetable and animal, including cochineal, logwood, etc., are attached to cloth in this manner. The fixing agents or mordants generally employed are different strengths of *red liquor* (acetate of alumina), *iron liquor* (acetate of iron), and mixtures of these. These are thickened with wheat-starch, potato-flour, roasted starch or dextrine, and gum-arabic, so that the mordant may not run when it is placed on the cloth by the pattern-block or by the printing machine. After the mordant has been imprinted on the cloth, the latter is hung in a warm, airy room, where it can easily dry, but where it is at the same time surrounded by a moist atmosphere. The result is, that the mordant is decomposed, the acetic acid is evolved, and the alumina or iron is left attached to the fibre of the cloth in the state of an insoluble sub-salt, which cannot be dissolved by water. As some of the mordant is still left in its original soluble condition, it is necessary to wash the cloth free from this, else, during the dyeing operation, the soluble part of the mordant would run on to those parts of the cloth not intended to be colored, and thus produce a blotted appearance. To obviate this, the cloth, having undergone the process of *drying* and *ageing*, is then introduced into a vat containing water, through which is diffused some cow-dung, dung substitute—a preparation of bone-ash, sulphuric acid, carbonate of soda, and glue—or bran. The result of this process of *dunging* is the removal of the soluble part of the mordant, as also the starch or thickening agent, leaving the decomposed or insoluble mordant adhering to the fibre. The terms *dung-fixing*, *substitute-fixing*, and *bran-fixing*, have reference to the employment of one or other of these agents at this stage of the operation. When the cloth has been well washed from the dunging, it is introduced into the vat or dye-beck containing the coloring matter. The whole is heated by steam-pipes, and the cloth being placed on a sparred reel kept in motion, is repeatedly wound out of the vat, and returned thereto. The result is, that wherever the mordant adhered to the cloth, the coloring matter is attached thereto, and little or no trace of color adheres to the unmordanted parts. The last operation is the *clearing* or *brightening*, during which the colored cloth is introduced into warm baths of water containing soda, soap, or, for the more delicate tints, bran, and is thereafter acted on by weak acid solutions. The object is to clear the colors, and at the same time to confer upon them the property of resisting the fading action of the air and sun for a much longer time. The different shades of color which can be obtained from the same madder beck or vat, with different mordants, are very numerous, and include reds, lilacs, purples, chocolates, and blacks. Thus, when a weak solution of red liquor (acetate of alumina) is employed as the mordant, a light-red tint is procured; with a stronger aluminous mordant, a deep red is formed on the cloth; with a more or less dilute solution of iron liquor (acetate of iron), the cloth is colored lilac, violet, or purple; with a strong solution of iron liquor, black is obtained. Indeed, the same piece of cloth stamped in different places with the various strengths of aluminous and iron mordants, and mixtures of these, and immersed in the madder-bath, will be obtained dyed with all the shades mentioned; and in this manner, many of the beautiful variegated colored dresses and handkerchiefs are prepared for market.

Iron.—Iron is a metal, and is a natural substance, but is not found in the state in which it is used. Metals are seldom met with pure, but are found combined with earthy matter in the form of rock, with sulphur, carbon, etc., and in this state are called ores. Metals are mineral substances, which are opaque, and possess a peculiar lustre; they are fusible by heat, and do not become transparent during fusion; most of them are malleable—capable of being hammered out into sheets; ductile—capable of being drawn into wire; and tenacious, or not easily divided.

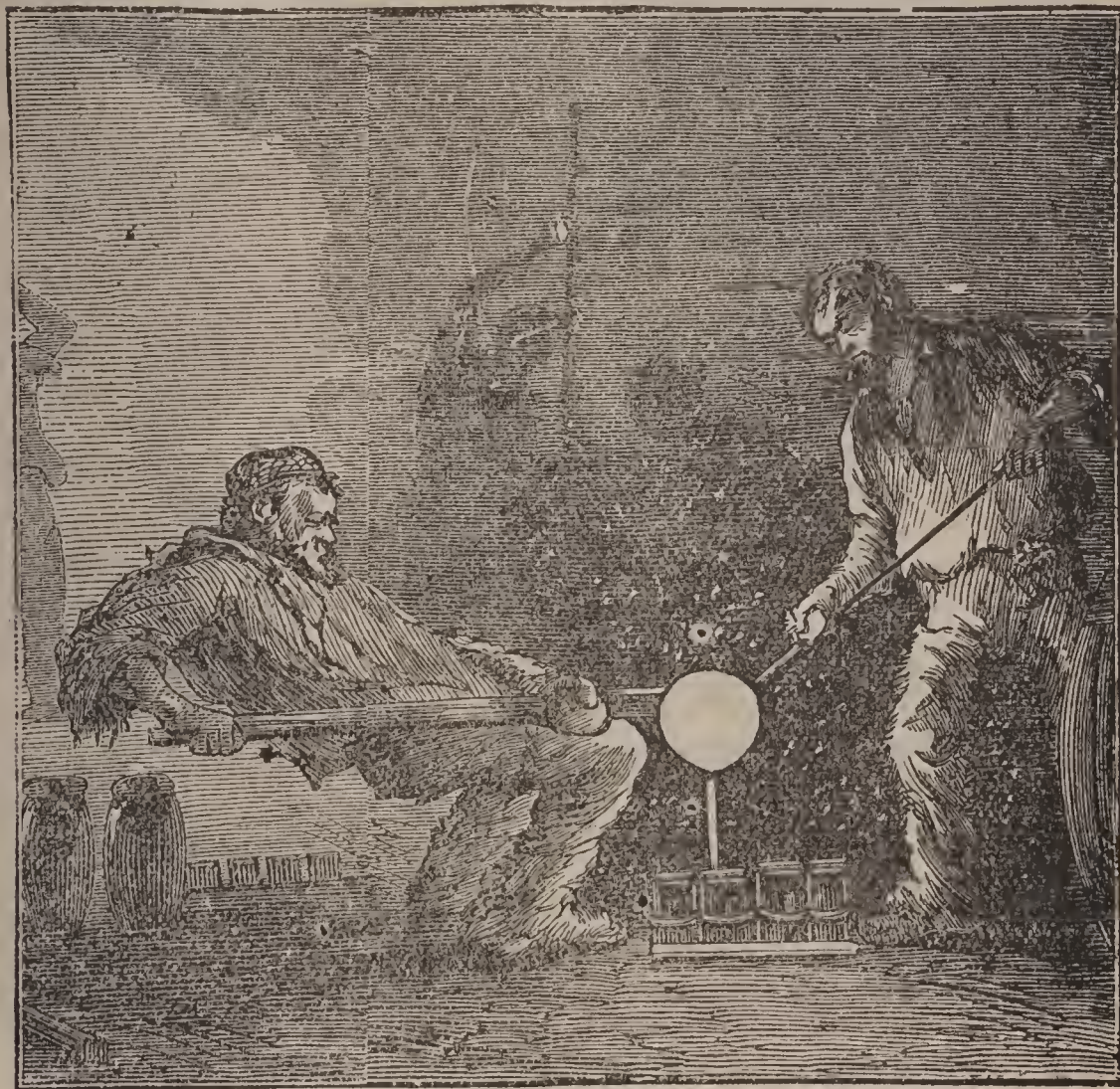
Cast iron is the term applied to iron which has been melted and poured into molds; it is the simplest form in which this metal is used. To obtain



PUDDLING IRON.

it the rough ore is first piled up with fuel and roasted in a kiln, which frees it from water, sulphur, arsenic, and other impurities which are capable of being *sublimed*—which means being driven off in fumes. The roasted ore is then smelted in a blast furnace, which is charged from the top with certain proportions of iron ore, coke and limestone; the last to act as a flux. Cast iron articles are made by using a quantity of this pig-iron melted in a furnace, and then the liquid iron, which looks like liquid fire, is poured out into molds and allowed to cool very gradually. These molds are usually made in a bed of fine wet sand; a curious instance of the employment of an apparently weak and fragile substance to mold or curb a strong one.

Wrought, otherwise called bar or malleable, iron is made from the rough pig-iron in this manner: It is first refined, which is chiefly done in the "puddling furnace," the iron being exposed to very great heat, and stirred about while a strong current of air plays over its surface; the intense heat consumes the carbonaceous matter remaining in the iron, and all the earthy impurities rise to the surface in the form of slag, and are allowed to run off. Gradually, as the iron becomes purer, its fusibility generally lessens, and it becomes tough like dough, even though the heat of the furnace be undiminished; it is then withdrawn, and while still red-hot is beaten with the forge hammer or subjected to rolling, by which means it becomes much more tenacious, from its particles being more closely compacted. This



MELTING STEEL.

process converts hard, brittle, fusible pig metal into a tough elastic bar; very malleable, but hardly fusible at all.

Steel.—To make steel from iron, bars of wrought iron are imbedded in pounded charcoal, and exposed to a furnace heat in close vessels; when withdrawn from the furnace the steel is found to have absorbed some of the charcoal, to be harder and more fusible, and its surface covered with small bubbles, hence it is called *blistered* steel. When several rods of this kind are heated in a box with a flux, and afterward hammered into one piece, it is called *shear steel*, because it is the most suitable for making shears,

scissors, etc. When this kind of steel is melted and run into ingots, it is termed *cast steel*, which is the most perfect form of the metal.

Steel is tempered by being plunged when red-hot into cold water or oil, by which means it becomes very hard, and can be made brittle and highly elastic; some things, such as a lancet, require the steel to be hard as adamant, but do not need strength, and break immediately; while for others, such as a trowel, the hardness must be associated with a toughness, which shall suffice to prevent it from breaking even with the roughest work; these extremes, and all intermediate stages, can be attained by regulating the processes of hardening and tempering.

Glass.—Glass is a transparent, hard, brittle substance, formed by the fusion of flint or sand and an alkali; generally soda, though for the finer sorts of glass potash is used. It is remarkable that though so perfectly transparent itself, none of the ingredients employed in the manufacture of glass possess that quality; and also, that an article which is brittle to a proverb, should, when heated, become so exceedingly ductile as to be capable of being molded into any and every form that may be desired, and drawn out into the finest thread.

Five kinds of glass are made: Flint glass, or crystal; crown glass, broad sheet glass, bottle, or green glass, and plate glass. Each of these kinds is made with silex and alkali; their different qualities being dependent on the proportion and degree of purity of these ingredients, and on various accessory materials; such as nitre, oxide of lead, of manganese, or of arsenic, borax or chalk. Formerly silex was sometimes used in the form of ground flint; now this is discontinued, and seasand is almost always employed.

For all kinds of glass, except flint, the materials, after being purified, are put into a furnace called a “calcar,” where they are “calcined,” this process is called *fritting*; the substance comes out soft and pasty, and is cut into squares which harden and are piled away for future use. In the final melting, the *frit* is put into glass pots, or crucibles, about twelve of which stand in each furnace; these crucibles sometimes hold as much as a ton of glass each, and are reached by openings in the wall of the furnace.

Glass does not become transparent as soon as it is melted; a white opaque porous scum, known by the name of sandiver or glass gall, rises to the surface, and till this is all cleared off the glass is not transparent, this scum, which appears to consist of salts and refuse alkali, is purchased by refiners of metals, who use it as a flux.

The molten glass is fashioned into the different articles in the following manner: It is cooled till it becomes a consistent tenacious mass, soft enough to yield to the slightest pressure, able to be bent and pulled into any shape without cracking. All kinds of small articles are made of flint glass; and to form these the workman then takes his blowpipe, collects a quantity of melted glass upon the end of it, and having rolled it upon a polished iron slab, called a marver, blows through the pipe, thus distending the glass into a hollow globe; this is repeated, the glass being frequently heated at the opening in the furnace, till it assumes the desired size; it is then transferred from the blowpipe to another rod, and the workman, with an instrument like a pair of sugar-tongs, bends, contracts or enlarges the vessel; any excess of material is cut away with shears as readily as a bit of soft leather. One other tool completes the number used in all the ordinary processes; this is a small flat iron plate with a handle, and is called a *battledore*; it is used to flatten the bottoms of tumblers, jugs, etc.

When completely formed the vessels are at once carried to the annealing oven called a *lear*, where they are heated and allowed to cool very gradually, without which precaution they would be liable to break with the slightest touch or change of temperature. The reason for this is, that crystalline substances expand with heat and contract in cooling, and as the degree of expansion exactly agrees with the degree of heat, anything like a tube or hollow vessel, which cools more slowly inside than outside, is very liable to be broken by the consequent derangement of the atoms—some being crushed by the unequal tension. The cure lies in placing the articles in such external heat as shall allow both surfaces to cool at the same rate.



GLASS MANUFACTURE.—ANNEALING FURNACE.

The larger and heavier the glass is the more difficult will it be to cool it safely. The annealing oven, or *lear*, is an arch with a furnace at one end, which is heated by coke, and which has a door at each end; this oven is very long, often sixty feet, but narrow; the floor is fitted with pans for receiving the glasses, which travel slowly on a miniature railroad from the hottest to the coolest end; the time employed for annealing varies, according to the size and weight of the articles, from six to sixty hours.

Sheets of crown glass, like those used for cutting into window-panes, are made as follows: The melted glass is collected on the blowpipe, as in the case of flint glass, and the workman gradually blows a globe; he then fastens on an iron rod to the side opposite that where the blowpipe is in-

serted, and takes the latter away, which leaves a hole; he heats the glass again, and begins twirling the rod; the glass yields to the impulse, its diameter increases, and it finally flies out into a flat disk fifty to sixty inches across, and having the rod attached in the center by a lump of glass commonly known as a bull's eye.

In making plate glass, great care is taken in the selection of such materials as will insure the greatest cleanness and most ready flowing of the glass; these are fused in the ordinary manner, and afterward removed from the large glass pots to smaller ones, also kept in the furnace, and from these the fluid glass is poured out on large flat iron tables constructed for the purpose; the tables are heated before being used; and a large copper roller is passed over the sheet of glass; as soon as it is set it is carefully removed into the annealing oven, where it remains about fifteen days. They are then what is termed rough plate, which is frequently used where great strength is more needed than transparency, but to finish the plate glass it must be squared, ground and polished; the grinding is performed by making a plate steady in a frame, and then causing another to rub steadily backward and forward upon it, with some grinding substance introduced between them; this is at first ground flint, and afterward as the roughness is lessened, emery powder is used; when perfectly smooth they are polished with leather cushions dressed with a red oxide of iron called colcothar.

In converting the plates of glass into mirrors or looking glasses, a flat smooth slab of wood or stone, enclosed in a wooden frame and fixed on a pivot, is adjusted horizontally; a sheet of gray paper is then stretched over it, and above this another of very thin tinfoil, and as much mercury is poured on as will rest on its flat surface; the plate of glass is then very carefully slid into the frame and deposited on the foil, and considerable weights are applied to its surface, which squeeze out the superfluous mercury; at the end of a day the under side of the glass is found to be covered with a thin soft amalgam of mercury and tin, which hardens by exposure, and causes the glass accurately to reflect.

China and Porcelain.—All kinds of pottery, from the finest to the coarsest, are composed of two ingredients, clay and flint baked together; but in porcelain these are of such kinds and in such proportions that the product is a semivitrified compound, in which one portion remains unaltered by the intensest heat, while the other vitrifies or becomes glass, and, enveloping the particles of the infusible ingredient, produces the smooth, compact, shining, semi-transparent substance we call porcelain.

In preparing the materials, the first part is the preparation of the clay. That from which English porcelain is composed is mostly found in Cornwall, Devonshire and Dorsetshire. The clay from the first named place, which is considered the finest, consists of decomposed felspar of granite, which is the rock most abounding in that county. The clay merchants prepare it by the following method, and send it to the potters under the name of china clay: The stone is broken up, and laid in running water, the clayey, or, as they are called, argillaceous parts, being the lightest, are carried off in suspension, while the quartz and mica, which were united with them in the granite, fall soon to the bottom. At some distance these rivulets end in catch-pools where the water is arrested, and after time has been allowed for the pure clay with which it was charged to settle and form a deposit, it is drawn off, and the clay dug out in square blocks, which are placed on shelves to dry in the air. It is now

a hard, white mass, which can by crushing be reduced to an impalpable powder.

The lumps of clay are first pounded and mixed with water to the consistence of cream, by means of various beating and cutting implements; the pulp is then strained through several sieves, each one finer than the last. The next process is preparing the flints, which are first burnt in a kiln and thrown, red-hot, into cold water, and afterward ground in water to an impalpable powder; the two dilutions of clay and flint are then brought together, stirred very thoroughly, and again strained, and so great is the affinity between them that, even when wet, they unite and form a mortar which no action of the atmosphere can decompose. This fluid mixture is called "slip," and is gradually evaporated in what are called "slip-kilns" to a consistence like dough. It is not yet in a state fit for molding into different articles, for it leaves the slip-kiln full of air-bubbles, which must be worked out by elaborate treading and kneading, generally with the naked feet, and after this is done, it should be left a long while before it is used, that the two elements may the more intimately unite. If placed in a damp cellar, the blocks of slip undergo a kind of fermentation, by which all traces of animal or vegetable matter which they may have contained are decomposed and got rid of; and this greatly improves its quality. So sensible are the Chinese of this that they extend the interval over fifteen or twenty years, and a parent will often provide a sufficient stock for his son's life.

There are three modes in use in shaping the vessels—throwing, pressing and casting; throwing is performed on a kind of lathe, which consists in a contrivance by which a small circular board revolves very rapidly, and on this the clay is measured, and its intended shape given to it, by the pressure of the fingers and palms of the potter's hands. The clay vessel thus molded is then partially dried before transferring it to the turning-lathe, where it is reduced by sharp tools to the required thickness, and its form carefully finished off; it next passes to a man who applies handles, spouts, and all other small appendages; these are fastened on with slip; all these small, irregular-shaped pieces are made by pressing in molds formed of plaster of Paris; and plates, saucers, and other shallow vessels, are formed in a mold, which is made to revolve on the block of the lathe, and into which the workman presses the clay with his hand.

The vessels are put into a furnace enclosed in deep clay boxes called *seggars*, capable of sustaining the most intense heat; these protect the ware from the flame and smoke; the process of baking lasts from forty-eight to fifty hours, the heat gradually increasing; trial pieces are placed where they can easily be abstracted to see how the process goes on, and when it is finished, the fires are put out, and all is left undisturbed twenty or thirty hours to cool. Bisque or biscuit is the name given to the ware after its first baking. It is so called from its resemblance to ship-bread. Many small vases, figures, and other articles of ornament are sold in this stage. The ware is afterward glazed by being dipped in a compound of litharge of lead and ground flints, glass, or some similar ingredients, mixed with water to the consistency of thin cream. The workman employed stands by a large tub or other reservoir, and, taking up the pieces of ware so that the smallest possible portion shall be covered by the fingers, he dexterously plunges it in, taking care that the glaze is equally distributed all over the article; it then passes to a woman, who scrapes off any superfluous glaze adhering to it. A skillful workman will dip about seven hundred dozen plates in a day. It is worthy of remark that the glaze, when applied, is perfectly opaque, so that any

painting or printing with which the article may have been ornamented is not visible until it has been fired. This second baking is done in a glass oven; the heat converts the flint, etc., into a thin coating of glass.

The next operation is painting, which requires to be done with peculiar metallic colors, united to a flux; these colors are moistened with gum-water or a peculiar oil, which causes them to adhere to the surface of the china until it is subjected to a slight firing, sufficient to fuse the glass or flint with which the colors are united; the paintings are thus burnt in, and acquire a gloss equal to the rest of the surface. Professed artists are employed for ornamenting china in this manner, and the most exquisite designs are frequently produced. For the common ware a much simpler process suffices, and this is done *before* the glazing instead of *after* it, as is the case with the painting. The pattern is printed from a copper-plate, on a thin paper, and this is transferred to the ware in the state of biscuit, when the color remains and the paper is removed; the glazing then proceeds as before noted. Gold

is applied to the finer wares in a metallic state, and, after burning on, requires burnishing with agate or blood-stone.



WATCH-MAKING.—THE WORK ROOM.

Watch-Making.—

There is no more wonderful or curious piece of mechanism than a watch. As it is the most interesting of all machines, so the process by which it is produced from simple wires of steel, plates of brass and ingots of gold or silver, is very curious. All the minute parts of a watch are made by machinery in this country.

Equally curious with the making of the minute screws is the fashioning of the other tiny parts. One machine punches a plain round piece of brass; another makes it a skeleton wheel; a third cuts the teeth on a score of wheels; yet another polishes it; then it goes into a room where it is immersed in a solution of gold, thus, gilding it; and it comes out one of those beautiful little wheels which you see moving so exactly on its pivot in the completed watch. Another apparatus is used to fashion the escapement wheels, with their oddly-turned teeth, and the compensation balance, the most conspicuous of all the wheels of a watch, with its two sections, held together by a thin, diametrical bar of steel, and its outer and inner rims of brass and steel. This compensation balance is one of the most important inventions in the modern watch, as the different degrees of the contraction or expansion, by cold or heat, of the copper and steel rims, keep the balance constant in all temperatures. No piece, however small, is put into a watch until it has been measured and weighed. There is also a gauging machine for measuring thickness, and still another

machine measures the hair springs. One of the most interesting rooms is that in which the dials, or white faces of the watches, are made. These are at first plain, round copper pieces, cut out of the sheets by machinery. A preparation of white enamel is spread over this copper piece; and when it is dry it is inserted into a red-hot hole, where the enamel is fused hard on the copper. It is then ground with fine sand and again subjected to fire to give it the glossy appearance which we see on the watch's face. Another curious room is that where the different brass pieces are gilded by means of batteries and gold solutions. The watches are tested, as to bearing different temperatures, by first being placed in little drawers where the air is made very warm, and then in similar little drawers where it is more than freezing cold.

Spectacles.—The white lens in use in the ordinary spectacle of commerce is made of the common window-pane glass rolled in sheets; sometimes it is made into balls. From these are cut pieces of about one and a

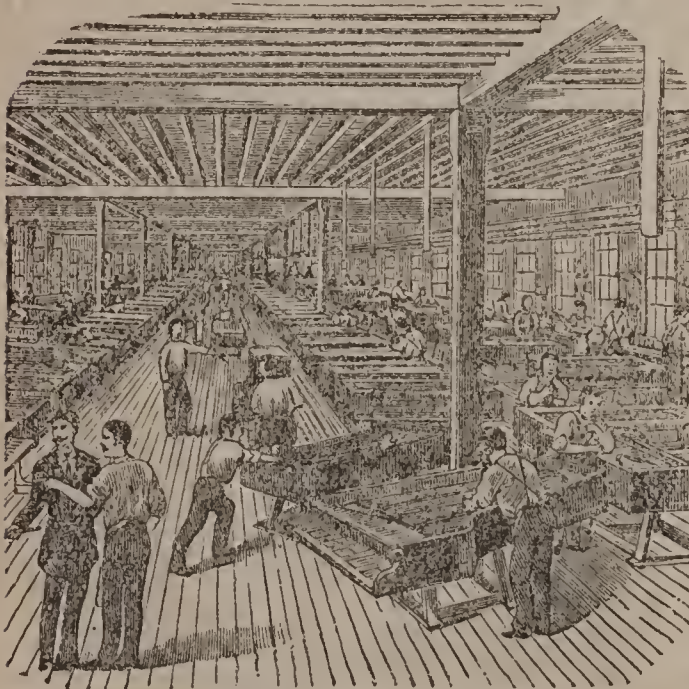
quarter to one and a half inches in size; they are then taken into the grinding room and each piece cemented separately upon what is called a lap of a semi-circular shape. These are made to fit into a corresponding curve or saucer, into which fine emery powder is introduced, and subjected to a swift, rotary motion. The gradual curve in the lap gives to the glass as it is ground a corresponding shape until the desired center is reached; the lap is then taken out and subjected to warmth, which melts the cement sufficiently to permit the glass being removed and turned upon the opposite



. WATCH-MAKING.—FIRING THE DIALS.

side, when the same process is renewed. This being completed, the lenses are detached again from the lap and taken to another department, where they are shaped to fit the frames. This is accomplished by a machine of extreme delicacy. Each piece of glass is put separately upon a rest, when a diamond is brought to bear upon it, moving in the form of an oval, thus cutting the desired size; but the edges, of course, are rough and sharp, and must be beveled. For this purpose they are turned over to another set of hands, mostly girls, who have charge of the grindstones, which are about six inches in thickness. Each operator is provided with a gauge; the glass is taken between the forefinger and the thumb, and held sufficiently sideways to produce half the desired bevel; when this is attained it is again turned and the other side of the bevel completed. During this process it is constantly gauged in order to ascertain that the frame will close upon it without too much pressure, which would break the lens. The next process to which the lens is subjected is that of "focusing," and requires extreme

care. The person having this department to attend to is placed in a small room alone; across the entrance is hung a curtain which is only drawn aside sufficiently to admit the required amount of light from a window several feet away, upon one of the top panes of which is placed a piece of heavy cardboard with a small hole cut in the center representing the bull's eye of a target. Through this the rays of light shine upon the lens in the hands of a workman, and are reflected through it to a dark background. The lens is then moved back and forth upon an inch measure until the proper focus is attained. Say, for instance, the extreme end of the measure is sixty-two inches, the lens is placed at that, but does not focus; it is gradually moved along inch by inch, until, perhaps, it is brought to thirty-six inches. At this the proper height of center or focus is attained, and it is then numbered thirty-six. The same operation is, of course, necessary with every lens. This accounts for the numbers which are upon spectacles or glasses of any kind when purchased.



PIANO-MAKING.—THE CASE ROOM.

there are the key makers, hammer makers, hammer leatherers, string makers, stringers, case makers, finishers, etc. The construction is a slow process, and cannot well be hurried, a grand piano usually requiring to be six months in making. One curious sight is a huge log of rosewood being gradually sawed into the thin strips used for veneering. The machine passes to and fro, shaving off only one veneer at a time, the strips growing larger at each passage of the saw, until the whole is cut up. There is a bewildering variety of machinery in use, each piece of which is full of interest. The most delicate operations are performed, such as making the small "action screws" and "bridge pins," "caps" and "dies." The case room is where the wooden bodies of the pianos are veneered and put together, and the adjusted pieces at last begin to take a shape familiar to you. More interesting still, perhaps, is the room where the rosewood veneers—the tops and sides of the piano—are being made to wear the perfectly smooth and shining appearance which you see on the finished instrument. These tops and sides are first well varnished in a large room devoted to this work; then they are carried to another room, where you see two men on each side

Piano-Making.—Almost most universal in use as is the piano, few people know how intricate an instrument it is; how many and delicate are its processes of manufacture; or are aware that years must elapse between the cutting of the various kinds of wood from which it is made, and its final appearance complete and beautiful. The manufacture of the instrument gives employment to a great variety of artisans, among whom the work of the several parts is minutely divided;

of a piano-top, rapidly rubbing it with pumice stone—a very hard piece of work. Then the pieces are polished, and rubbed with “rotten stone,” and finally come out perfectly smooth.

Perfumery.—There is, perhaps, no occupation which is exactly so poetical in its surroundings as the perfumer's is; that is, the perfumer who distills his essences and infuses his extracts at first hand among the flowers, and not among the chemist's bottles in the shop. Where he dwells and works it is usually in the South, where groves of oranges and lemons are not too far away to give him their buds, and where acres of flowers bloom all about him—fields of the violet, of the rose, of the geranium, the verbena, the lily-of-the-valley, the jasmine, tuberose, hyacinth, jonquil, and myrtle, and all the rest of the sweet sisterhood. These flowers, each in its season, his employees gather, always at nightfall or at early dawn, when the dew is on them. Brought in in large hampers, they are piled handful by handful

on a frame, over which has previously been stretched a cloth, often resembling cotton-flannel, moistened in odorless olive or almond oil. When the frame is filled, another is fitted over it, and that in turn is heaped; and the fitting and heaping are continued till a ponderous pile is prepared, which is left a couple of days, and then fresh flowers replace the first, and the process is repeated every two days for a fortnight. At the end of this time, the last flowers being removed, the cloths are taken from the frames, and the oil with which they were moistened is wrung away from them under great



PIANO-MAKING.—THE POLISHING ROOM.

pressure, and is found to be heavily and deliciously charged with the aroma of the flowers used. In order to make the finest extracts, this oil is used with double its weight of pure rectified spirit in a vessel known among cooks as a digester; that is, a porcelain or block-tin kettle that fits in another kettle, the outer one filled with boiling water. In this vessel the contents digest during three or four days, being very frequently shaken the while. Then, having been set to cool, the spirit is decanted into another vessel holding the same quantity of the perfumed oil, and the process is repeated. After the third repetition the spirit has taken up enough of the perfume, and it is carefully decanted from the oil, for the last time, through a tube, one end of which is filled with cotton-wool; and it is then pronounced to be the choicest extract known, usually called “triple-extract,” possessing an exquisite delicacy that belongs to no other preparation.

Soap.—Soap is a compound formed by the union of an unctuous substance and an alkali. Soaps are of two kinds, hard and soft, differing from

each other in the materials used in their manufacture, and in the uses to which they are applied; the latter kind being chiefly used in cleansing of stuffs and silks. Hard soaps are made from animal fats, or vegetable fat oils, and soda; soft soaps of fish oil or vegetable drying oils, and potash; soda soaps are invariably harder than potash soaps, when the oleaginous substance is the same. Soap purifies only by virtue of its alkali, part of which combines with the greasy matter to be removed by washing.

The soda is chiefly obtained from the decomposition of sea salt, the lye being frequently made with the unpurified soda in the state of black-ash. The potash is obtained by calcinizing wood-ashes. The principal oily ingredients are tallow or animal fat, and palm-oil, which is obtained from the fruit of the *Elais Guianensis*, or oil palm, a native of the west coast of Africa, where it is extensively cultivated. Olive oil, whale, seal, and cod



THE MANUFACTURE OF SOAP.

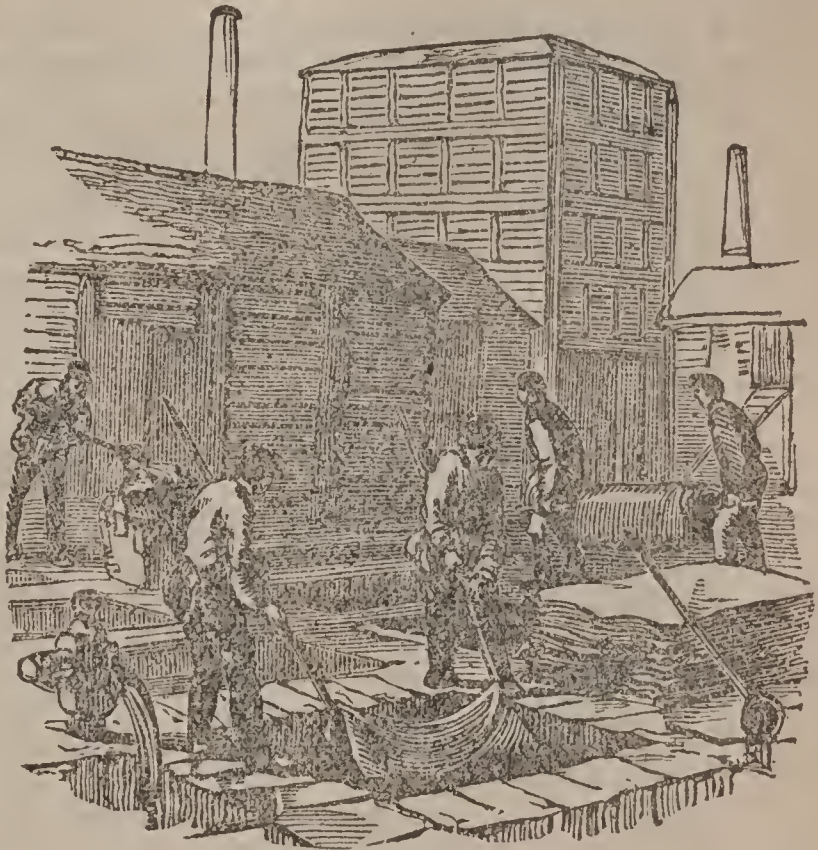
oil are also used in smaller quantities; a portion of resin is put into yellow soap.

The whole quantity of tallow or oil intended to be used is put into the soap-pan (a large iron boiler) at once, but the alkali is supplied at several successive times, the exhausted lyes being pumped out and fresh ones added; a quantity of salt is put into the pan when it is desired to separate the soap from the lye in which it is suspended. Two or three boilings are usually given to it for as many successive days.

When the soap is properly formed, the lye is carefully separated from it, and then it is removed in buckets, to the "frame room," where it is poured into large frames which are like bins, their sides being bolted together. Here the pasty mass is stirred and raked about with a little water to make the grain finer and more equable, and it is then allowed to solidify; when it is quite firm the frame is unbolted and taken off, and a block of soap remains, which is cut up into bars and stowed away to dry. Soft soaps are

made in a similar manner, only the exhausted lyes are not pumped off. These soaps always contain half their weight of water; hard soaps may be reckoned to contain one part alkali, nine parts greasy matter, and five or six parts water.

Leather.--This useful article consists essentially of the skins of animals chemically altered by the vegetable principle called tannin or tannic acid, so as to arrest decomposition. The skins of all animals used in the production of leather consist chiefly of gelatine, a substance which easily enters into chemical combination with the tannic acid found in the bark of most kinds of trees, and forms what may be termed an insoluble *tannogelatin*. This is the whole theory of tanning, or converting the skins of animals into leather. Formerly, oak-bark was supposed to be the only tanning material of any value; but lately, very numerous additions have been made to this branch of economic botany. In addition to the process of tanning in making leather, there are other modes, one of which is *tawing*, another *dressing in oil*. The following are the skins which form the staple of our leather manufacture: ox, cow, calf, and kip, buffalo, horse, sheep, lamb, goat, kid, deer, dog, seal, and hog.



A TAN-YARD.

Starch.--Starch or amylaceous matter is an organized substance of the

class known as carbo-hydrates, which occurs in roundish or oval grains in the cellular tissue of certain parts of plants. It is very widely diffused through the vegetable kingdom, and is especially abundant in the seeds of the cereals, in the seeds of leguminous plants such as peas and beans, in the tuber of the potato, in the roots of arrowroot and tapioca, in the pith of the sago palm, etc. The grains of starch from the same kind of plant are tolerably uniform in size and shape, but vary in different species of plants from 1-260th to less than 1-3000th of an inch in diameter; and while some are circular or oval, others are angular; moreover, among other differences, some (chiefly the larger grains) exhibit a series of concentric rings, while in others no rings are apparent; and while the grains of potato-starch, if illuminated by polarized light, with a prism placed between the object and the eye, present a well-marked black cross, in wheat-starch no such cross is seen,

Ordinary commercial starch occurs either as a white, glistening powder, or in masses which are readily pulverized; and when pressed between the fingers it evolves a slight but peculiar sound. It is heavier than water, and is insoluble in cold water, alcohol, and ether. If, however, it be placed in water at a temperature of 150° , its granules swell from the absorption of fluid, and the mixture assumes a viscid, pasty consistence. Dilute acids rapidly induce a similar change, even without the agency of heat; and if heated with dilute sulphuric acid, the starch is first converted into dextrine, and finally into glycose or grape-sugar; and manufacturing chemists avail themselves of this property to obtain glycose on a large scale from starch. Starch dissolves in cold nitric acid, and on the addition of water to this solution, a white, tasteless, insoluble precipitate falls, which is known as *Xyloidin*, and explodes violently when struck by a hammer, or when heated up to about 350° . The composition of this substance is not positively known, but in all probability one or two equivalents of the hydrogen of the starch (most probably two) are replaced by a corresponding number of equivalents of peroxide of nitrogen.

The reactions of starch with iodine and bromine are very remarkable. Iodine communicates to it a very beautiful purple color, and hence starch-paste serves as a delicate test for free iodine. The purple color which the iodine gives to the starch granules appears not to depend on a chemical combination, because on the application of heat the color disappears, and reappears on cooling. Bromine communicates a brilliant orange tint to starch—a reaction by which the presence of free bromine may be readily detected. When heated to a temperature of from 340° to 400° , dry starch is converted into Dextrine, or British gum. At a higher temperature, it undergoes decomposition, and yields on dry distillation the same products as sugar. When heated in steam under pressure, it also passes into dextrine, and finally into glycose. The addition of a little sulphuric acid hastens these changes.

During the germination of seed, the starch undergoes a kind of fermentation, and is converted into a mixture of dextrine and glycose. This change is due to the action of a peculiar ferment termed *Diastase*, which exists in all germinating seeds during the process of growth, and is probably a mixture of albumen and gluten in a special stage of decomposition. Various animal matters, as, for example, saliva, pancreatic juice, the serum of the blood, bile, etc., exert the same action on starch as diastase. On treating starch with chlorine, a remarkable, colorless, oily fluid, *Chloral*, is obtained. On prolonged exposure to the air, starch paste becomes acid, in consequence of the formation of lactic acid.

Starch is usually obtained by a simply mechanical separation of it from the other ingredients with which it is associated; advantage being taken of its insolubility in cold water. The details of the mode of separation vary according to the source from which it is procured. We extract from Miller's "Organic Chemistry" the method of procuring *potato starch*: "This variety is prepared on a large scale from potatoes, which contain about 20 per cent. of amylaceous matter. The cellular tissue of the tuber does not exceed 2 per cent. of the mass; while of the remainder about 76 per cent. consists of water, and the rest of small quantities of sugar, salts, and azotized matters. In order to extract the starch, the tubers are first freed from adhering earth by a thorough washing, and are then rasped by machinery. The pulp thus obtained is received upon a sieve, and is washed continually by a gentle stream of water so long as the washings run through milky. This milkiness

is due to the granules of starch which are held in suspension. The milky liquid is received into vats, in which the amylaceous matter is allowed to subside; the supernatant water is drawn off, and the deposit is repeatedly washed with fresh water until the washings are no longer colored. The starch is then suspended in a small portion of water run through a fine sieve to keep back any portions of sand, and after having been again allowed to settle, is drained in baskets lined with ticking; the mass is then placed upon a porous floor of half-baked tiles, and dried in a current of air, which is at first of the natural temperature; the drying is completed by the application of a moderate artificial heat." To obtain starch from wheat or rice, a more complicated process is required, as the large quantity of gluten which is associated with the starch in these grains requires to be removed either by



MAPLE SUGAR.—GATHERING THE SAP.

fermentation, or, according to Jones's patent, by a weak alkaline solution, which dissolves the gluten, but does not affect the starch granules.

Commercially, there are two classes of starch—those used for food, and those used for manufacturing purposes. The latter are chiefly made from wheat, rice, and potatoes; but in addition, large quantities of sago starch are prepared in India, and small quantities are from time to time prepared from other sources, such as the fruit of the horse-chestnut, etc.

Maple Sugar.—The sugar maple tree resembles the sycamore, and abounds in the northern parts of the United States, and in the British possessions, where large quantities of sugar are made from it. The trunk of the sugar maple is generally more slender than that of the sycamore. To obtain sugar, holes are bored in the trunk when the sap is ascending, early in spring, before the winter frost has passed away, in an obliquely ascending direction, at no great distance from the ground, at first only to the depth of half an inch, but afterwards deepened to two inches; and the sap thus collected is evaporated in boilers over a brisk fire, to the consistency of syrup,

strained and poured into molds, in which it crystallizes into a coarse gray or brown colored sugar. It is sometimes afterwards refined. Four gallons of sap yield about one pound of sugar. A single tree yields from two to six pounds in a season. During the sugar making season, sheds are erected in the woods for the boiling and other processes of the manufacture. The sap cannot be kept long after being collected.

Wall Paper.—In the manufacture of wall paper, the “blotching machine” performs the first operation. A web of blank paper is set in a reel behind one of these machines. The free end of the paper on the web is pulled forward and placed between two cylinders which drag it into the machine, where a roller, part of which is working in a “color pan” filled with thin paint, is working. This roller puts a large quantity of color upon the paper, and a set of flat brushes called “jiggers” work rapidly back and forward, working this coloring matter in and spreading it evenly over the surface of the paper, so that when the cylinders of the rear end of the machine drag it out it is thoroughly painted in water color on one side.

As it issues from the blotching machine a workman takes the free end of the paper and wraps it around a stick, which is carried up an incline by two parallel endless chains. After eighteen feet of the paper have run out, these chains pick up another stick which lies across them and bears a paper upon it. This last stick chases the first one up and gains upon it till only a foot behind, when it stops gaining and both travel along maintaining that relative distance, with the paper between them looped down till it nearly touches the floor. A hundred other sticks do precisely as the second one did, and the result is that there are soon a hundred loops of paper, each loop containing eighteen feet. The elevated railway of parallel chains on which the sticks from which the paper is looped are traveling turns corners of the building at will, and soon the blotching machine has run the whole web out, and it is hanging in loops over a system of steam pipes, which dry it so fast, as it moves along, that it is perfectly dry before it reaches the farther end of the chain railway, where a boy with a reel winds it back into web form again.

The designs are first sketched out on paper and then transferred by an ordinary process on the faces of rollers made to suit the size required—an eighteen inch design, for instance, requiring a roller six inches in diameter. May be the design requires printing in twelve colors (that is the highest number ordinarily run); to do this twelve rollers would be prepared, each having the design upon it and each of a size exactly equal to that of the others. When the rollers are all prepared the artist will direct skilled workmen who are with him to fix one up to take the brown, another red, another yellow, and so on with all the other colors. Let the brown color serve as an example for all.

The workman takes it to his bench, where there is a vise and hammers and files and piles of brass made into thick ribbons and rods. Here he sets the roller in the grasp of the vise and goes to work on it. Every bit of the design which is to be in brown is traced out for him and he reproduces it in relief on the roller with his bronze wires and rods and ribbons, which he drives into the hard wood so solidly that they stick there as if they had grown. The brass wire can be given any ordinary shape necessary by drawing it by machinery through a hole of corresponding shape in a steel bar. This is the way that the roller, which will print in brown, is first fitted up. When it is finished it bears on its face, in raised brass, fragments of leaves

and parts of birds and ears of wheat, and little and apparently unnecessary and unshaped points of metal, all of which at the proper place and time will put the brown coloring and shading in exactly the place where the designer wants it to go.

When the roller has had all its share of the design hammered into it, it is taken away to a turning-lathe, when the face of all the brass work is struck on one side by pumice stone and on the other by a file, and gradually brought down to perfect smoothness and evenness and the exact size needed. All the other rollers are treated in the way indicated, each getting its share of the design hammered into its face in brass work and each afterward being reduced to smoothness and the proper size by the file and pumice stone. It sometimes costs one thousand dollars to get up a set of



MANUFACTURE OF TURPENTINE, RESIN AND TAR.—FIG. 1.

rollers in this fashion, and they, may be, take three or four weeks in preparation.

When the rollers are prepared they are taken to a press which consists of a very large cylinder of the width of ordinary wall paper. Around the bottom and sides of this cylinder are grooves into which the rods on the ends of the rollers fit, the faces of the rollers just touching the cylinder when they are in position. To each of the rollers comes from below it an endless cloth band, which works upward from a color pan in which the coloring matter to be used on the particular parts of the design carried on the roller in question is lying in the shape of a thin liquid. Each of the rollers is registered, that is, turned so that the portion of the design upon it will exactly strike in the spot necessitated by the relative position of the other rollers. When all is thus arranged and the paper, which has previously passed through the blötcher, is conducted between the cylinder and the

first roller, the machine is started; cylinder and rollers revolve at once, each of the latter printing its color just where it was intended, and a steel scraper called a doctor, lying at each of the endless cloth bands spoken of, seeing to it that not too much liquid from the other pans gets on the rollers. The press works very rapidly, throwing off ten rolls of the paper a minute, and each roll contains sixteen yards.

Turpentine, Resin and Tar.—The long-leaved pine of the Southern States furnishes the chief source of supply of turpentine, resin, tar and pitch. This tree grows from the northeastern boundary of North Carolina, along the Atlantic coast to Florida, across that State to the Gulf, and thence to Louisiana, in a belt averaging one hundred miles in width.

The first step is to obtain the crude turpentine. This is the natural juice



MANUFACTURE OF TURPENTINE, RESIN AND TAR.—FIG. 2.

of the pine tree, and it is sometimes called white turpentine and gum turpentine. It is a mixture of the essential oil known as spirits of turpentine and of resin. A half-moon shaped box is cut in the tree, as near as possible to the surface of the ground. The shape of this "box" will be seen in Figs. 1, 2, 3 and 4. The box cutting commences about the first of December and continues till March—perhaps a few weeks longer if the spring is late. After cutting, the boxes are "cornered" by taking out a triangular piece at each end of the half moon. This is the commencement of the regular season, and the boxes are now all tasked off. A "task" is usually ten thousand boxes, but we have known hands to tend eighteen thousand. These must be cornered once, and "hacked" about six times, from the first of spring until into November. The dipping (shown in Fig. 2) is done by task work, too, so many barrels or boxes per day being a task. This is accomplished with a spoon-shaped instrument and a peculiar twist of the

wrist, only well done by long practice. Two dippers generally attend one hacker. Hacking is the making a groove-shape cut on each side, downward to the center of the half moon. The grooves can be seen in all the cuts.

The "hacker" is used with a downward stroke, and has at the lower end of the handle a weight of lead or iron, to give great impetus to the blow. The barrels for filling are placed at intervals through the woods; the dipper gathers his gum in a rude bucket, and empties it into the barrels, which, when filled, are hauled off. A frequent mode of hauling is seen in Fig. 1; the same cut shows a primitive but cheap mode of "rolling" tar to market. Both articles are frequently rafted to a seaport between sticks of hewn timber.

The first year's operation produces "virgin dip," the second "yellow



MANUFACTURE OF TURPENTINE, RESIN AND TAR.—FIG. 3.

dip," the third some common yellow dip and scrape; then the further product of the trees is all "scrape." The virgin dip is, when carefully gathered, a honey-like gum, of whitish appearance. From it are produced No. 1, pale, extra, and window-glass resins. It yields about seven gallons of spirits, and not quite three-fourths of a barrel of resin to the barrel (two hundred and eighty pounds). Yellow dip yields over three-fourths of resin, and about six gallons of spirits to the two hundred and eighty pounds of gum. Scrape yields about the same. "Scrape" is the gum which gathers on the face of the tree or box when worked up three, four or more feet higher. It is a white and cheesy-like substance. The operation of chipping the box face and gathering the scrape is seen in Figs. 3 and 4. With care a very light resin can be made from it.

The operation of distilling the gum is carried on in turnip-shaped copper stills of a capacity from ten barrels up to sixty—the ordinary size being

twenty and thirty barrels. They are bricked up at the sides, and the fire strikes directly on the bottom. The top has a large hole for the "cap," which connects with the worm for condensing the spirits, and a small hole through which the "stiller" examines the state of his charge, and lets in water as it may be deemed necessary. The resin, being a residuum, is let off on one side into vats, through strainers, from which it is dipped into barrels to cool. Many attempts have been made to use steam as a heating agent, but not yet with success. If the resin is not entirely free of either spirits or water it is opaque and loses value.

The rear of the stills and the resin vats are shown in Fig. 5. Probably the largest distillery in the country is at Wilmington, N. C.

In trees deadened by fire, stumps of trees cut down when the sap is up,



MANUFACTURE OF TURPENTINE, RESIN AND TAR.—FIG. 4.

and old box trees left standing, a peculiar transformation of the wood takes place; all its pores become filled with pitchy matter, it increases greatly in weight, and will take fire almost as readily as gunpowder. In this state it is called "light wood," because it is used for kindling, and with the poor as a substitute for candles or other light. The smothered burning of this wood is the source of tar. The wood is split into billets three or four feet long and about three inches in diameter. To form a tar kiln the operation is commenced by scooping out of the ground a saucer-shaped foundation, making a hole in its middle, and thence running a wooden spout outside the rim of the foundation. Billets of wood are then placed radiating to this center hole and piled upward, each upper and outer stick lapping a little over, so that when finished, the pile (as shown in Fig. 6) resembles a cone with the point cut off, small end down; logs of wood and green twigs are then piled around, and the kiln thus made is covered with dirt, the top as well as sides. The

fire is then lighted at the top eaves of the kiln, and the tar trickles down to the center hole, whence it runs out through the spout. A kiln yields fifty, one hundred or more barrels of tar, according to its size. Large iron retorts have been used, but the project is not sufficiently greater or more cleanly to pay for increased cost. In process of distillation a tar and pitch are obtained. Pitch is tar boiled down until all its volatile matter is driven off.

Paper Money.—In the Treasury Department at Washington every dollar of United States money is made. Almost a million of dollars of old, worn-out money is counted and destroyed there daily. Of course new bills are printed to supply the place of those worn out and destroyed.

When they are destroyed they are first counted by several persons, so that there can be no mistake, and the amounts marked. The money is then



MANUFACTURE OF TURPENTINE, RESIN AND TAR.—FIG. 5.

placed in a large receiver of iron, which is nearly the shape of two tin pans with the edges shut together, only very much larger—six or seven feet in diameter. To this iron receiver there is a door which is locked with three locks, each lock requiring a different kind of key. Three men, who are appointed in accordance with law to witness the destruction of this money, have each one of the keys to this door. No one of the men can lend his key to either of the others or to any other person. Now, at the proper time of day these three men get together, and each one takes his key, and they unlock the three locks of the door, which is then opened. All this old money—so many hundreds of thousands of dollars—is then carefully placed in the receiver, the door is closed, and the three men securely lock it. Water is then let in through a pipe, and a machine inside beats and grinds all these hundreds of thousands of dollars into the finest pulp. When it is sufficiently ground it is taken out and used to make paper of.

As previously stated, new bills are printed to take the place of those destroyed, and also to supply money required to be used in the country. If you will look very carefully indeed at a new bill, you will notice that it is made of a peculiar kind of paper, very different from newspaper. It is very tough. Take a new bill, and you will find in the paper itself something that looks like a fine kind of hair running through each bill in one particular place. Now, that paper is made just so in order that no one may be able to counterfeit the bills, for the Government takes care that no one shall ever get even a sheet of that paper. So if a bill hasn't got those hairs running through it in a particular place, we know at once it is worthless, or a "counterfeit" bill.

This paper is first made in large sheets, and every sheet that comes in to be printed is carefully counted, so that if a single sheet were stolen or



MANUFACTURE OF TURPENTINE, RESIN AND TAR.—FIG. 6.

lost the theft or loss would be promptly detected. When the paper comes in, in great packages of these large sheets, each sheet is carefully moistened, so that it will take up the ink properly, and is then placed under a press, when a die or stamp of the most perfect workmanship makes an impression, of one color only, on one side. When it becomes dry it is moistened again, and is again placed under a press, and another impression of another color is made, and this process is repeated many times, till all the colors of both sides have been impressed. This printing is done in sheets, several bills being printed at once on one sheet. After this is done the sheets are dried and put under great pressure to take all wrinkles out and make them entirely smooth. The bills are then trimmed and separated by machinery, and numbered by a curious little machine that changes its number at every impression, thus, 1, 2, 3, 4, etc., so that no two bills of the same kind have the same number on them.

Postal Cards.—The country uses over three hundred million postal cards a year. This is a million a day, or several tons every twenty-four hours. They are manufactured by private corporations or firms, the Government inviting bids and awarding the contract for their manufacture at stated intervals. The sheets are about thirty by twenty-two inches in size, and are just fitted by the plates from which the cards are printed, each plate covering forty cards, four in width and ten in length. The printing is done on Hoe super-royal presses, by skillful pressmen, and as each sheet passes into the press the number of cards is unerringly recorded by registers attached to the presses, and which are carefully looked every night to prevent any tampering. The sheets are then piled up and allowed to dry, in order that they may not be damaged by future handling. After drying thoroughly, the sheets are then passed through the rotary slitter—a machine fitted with circular knives, which cuts them into strips of ten cards each, and trims the edge of the outside strip. The strips are then passed transversely through the rotary cross-cutters, the mechanism of which is similar to the “slitters.” The cross-cutters divide the strips into the single cards, which drop into a rotary hopper containing ten compartments. As soon as each compartment has received twenty-five cards, the hopper revolves and throws the cards out upon a table. A number of girls then take them, and bind the perfect ones in packs of twenty-five each. Other girls then take the packs, and, after recounting them, put them in pasteboard boxes containing twenty packs, or five hundred cards each. The cards are then ready for shipment to the various post-offices throughout the country. By the stipulation of the contract the manufacturers are required to keep at least ten million postal cards in store all the time.

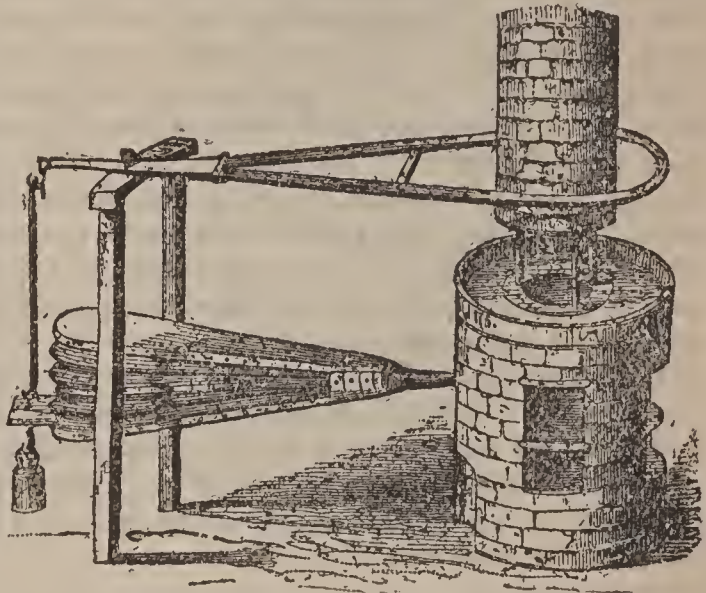
Postage Stamps.—In printing, steel plates are used, on which two hundred stamps are engraved. Two men are kept hard at work covering them with colored inks, and passing them to a man and a girl, who are equally busy at printing them with large rolling hand-presses. Three of these little squads are employed all the time, although ten presses can be put into use in case of necessity. After the small sheets of paper upon which the two hundred stamps are engraved have dried enough they are sent into another room and gummed. The gum used for this purpose is a peculiar composition, made of the powder of dried potatoes and other vegetables, mixed with water, which is better than any other material; for instance, gum arabic, which cracks the paper badly. This paper is of a peculiar texture, somewhat similar to that used for bank notes. After having been again dried, this time on little racks, which are fanned by steam power, for about an hour, they are put between sheets of pasteboard and pressed in hydraulic presses, capable of applying a weight of two thousand tons. The next thing is to cut the sheets in half, each sheet, of course, when cut, containing a hundred stamps. This is done by a girl, with a large pair of shears, by hand being preferred to that of machinery, which method would destroy too many stamps. They are then passed to other squads, who, in as many operations, perforate the paper between the stamps. Next they are pressed once more, and then packed and labeled, and stowed away in another room, preparatory to being put in mail bags for despatching to fulfill orders. If a single stamp is torn, or in any way mutilated, the whole sheet of one hundred stamps is burned. Five hundred thousand are burned every week from this cause. For the past twenty years not a sheet has been lost, such care has been taken in counting them. Each sheet is counted eleven times.

Envelopes.—A modern envelope machine is one of the most interesting of mechanical novelties. All the manual labor that is required in attending to the machine is limited to the supply from time to time of a pile of envelope blanks, and the occasional removal and banding of the finished envelopes. Thus the entire and various processes of feeding, gumming, stamping, folding, delivery, and collection are performed automatically by a series of mechanical operations devised with the utmost ingenuity and carried out in perfection; the machine withal being excessively compact and well arranged. The pile of envelope blanks being placed in position on a plate at one end of the machine, which may be done either at rest or in motion, the feeding process is effected by the simple aid of intermittent suction. An elastic tube has a trumpet-shaped brass mouthpiece which descends on the uppermost blank, and at the moment of contact the air is exhausted by a stroke of the air-pump, when the mouthpiece rises with the blank attached; the suction being maintained just sufficiently long to enable the arm and grippers, rapidly projected from the other side of the machine, to seize the blank, when the attachment to the mouthpiece ceases and the arm shoots back, drawing the blank into position over the folding-box, and there rapidly releasing it. At this moment the stamping is effected by the action of a hammer and die, and the gum is applied in due place on the edges of the side flaps, whereupon a plunger-head, of the rectangular form and size of the envelope, descends, carrying the blank down into the folding box; the flaps, thus raised into a vertical position, are then inclosed and folded down in proper sequence by slides working in the thickness of the folding box; and finally the bottom of the box rises and completes the operation by pressing the whole against the slides, so that the edges are made sharp and the adhesion is effected and secured. The slides are then withdrawn, and the bottom of the folding-box drops, allowing the envelope to drop in a vertical position into the delivery-trough underneath, running across the machine, wherein, by a simple contrivance and combination of guides, holders, and pressers, the envelopes as they drop from the folding-box are successively, uniformly and regularly arranged, and worked along the trough ready for removal and banding by the attendant. These manifold operations are successively wrought with such speed that the finished envelopes are turned out complete at the rate of fifty per minute, or three thousand per hour.

Paper Car Wheels, Etc.—Paper car wheels are composed entirely of paper rings pressed together under a weight of six tons, and then fastened by means of bolts and steel tire put on them, when they are ready for use. Laid loosely, the rings stack as high as the shoulders of an ordinary man. Under treatment they sink to the thickness required. If the tire should wear or fall off the wheel, or the train run from the track, there would be no danger of their breaking, as they are very flexible, and would spring. A paper ball can be rendered so solid that nothing but a diamond tool can cause an indentation into it. At the mill is a square block of compressed paper fastened on a turning lathe, and so hard that, if a fine steel chisel is held against it when it is moving, instead of cutting the paper it will break the chisel into a hundred pieces. The strength is astonishing. You can take a £5 note of the Bank of England, twist it into a kind of rope, suspend three hundred and thirty-nine pounds upon one end of it, and it will not injure it in the slightest degree. Bath tubs and pots are formed by compressing the paper made out of linen fibres and annealed—that is, painted over with a composition which becomes a part thereof, and is fire-proof.

The tubs last indefinitely, never leak, and, put in the fire, will not burn up. You can beat on them with a hammer and not injure them. Plates compressed and annealed are very durable; you cannot only wash them, but drop them upon the floor and stand upon them. The fork can be used for any practical purpose, and the knife can always be kept sharp. Paper can be substituted for wood, converted into picture-frames and colored like walnut, cherry, and the like. Bedsteads are fashioned the same as car wheels, only of long strips instead of rings. They are very beautiful and lasting. Cooking or heating stoves are also annealed, and it is impossible to burn them out. They are less costly than iron. A house can be literally constructed and furnished with every convenience in paper. The printing-press, type, and all the fixtures of the office could be concocted of this material, and more cheaply than of the ordinary kind. A complete steam-engine can be thus manufactured and do all required duty. Clothes and shoes will come in the future. Twenty-nine hours are needed to transfer linen fibre into a car wheel.

Nails.—Formerly, all nails were hand made, by forging on an anvil; and vast quantities are still made in this manner, being preferable, for many kinds of carpenter's work, to those made by machinery. The iron used for hand nail-making is sold in bundles, and is called *nail-rods*; it is either prepared by rolling the malleable iron into rods or small bars of the required thickness—which process is only employed for very fine qualities—or by cutting plate iron into strips by means of rolling-shears; these shears consist of two powerful revolving shafts, upon which are fixed disks of hard steel with squared edges. The disks of one shaft alternate with those of the other; they are of the thickness of the plate to be cut, and the shafts are so placed that a small portion of one set of the disks are inserted between those of the other set. When the shafts are revolving a plate of iron is pressed between the disks, and it is forcibly drawn through, the steel disks cutting the plates into strips with great rapidity. The quantity produced in this way is enormous, some mills turning out at the rate of ten miles per hour of nail-rods. Several inventions, in which America took the lead, have been introduced, and are successfully worked, for making nails direct from plate iron, either by cutting them out cold or hot; and a very large proportion of the nails in use are made in this way. Nail-making by machinery was originated in Massachusetts in 1810.



NAIL FORGE.

Lead Pencils.—A lead pencil is in itself a small affair, but considered as a manufactured product, it rises into much importance. To start a first-class factory with improved machinery and stock of well-seasoned wood,

requires a capital of about \$100,000; the ground covered is about half an acre, chiefly occupied by drying houses for the storage of red cedar. The Florida red cedar is mostly used in this country and in Europe—some “iben” wood, as the Germans call it, or English yew, is used in Germany—white pine is occasionally used for a common grade of a carpenter’s pencil. The “lead” of the pencils is the well-known graphite or plumbago; the best of this is the natural, found in a pure state in masses large enough to cut into strips. Of this there is but one mine up to the standard, which is in Asiatic Siberia. What was formerly refuse in cutting the graphite is now ground, cleaned, and refined, and then mixed with a fine clay. In mixing the clay and graphite, great care must be taken in selecting and cleaning the clay and getting the proper proportions; the mixture with water, after being well-kneaded, is placed in a large receiver and strongly compressed and forced out through a small groove in the bottom, in the shape of a thread the thickness and style required—either square, octagon, or round. This thread or lead wire is cut in bars of proper length (done by little girls), and then straightened, dried at a moderate heat, and packed in air-tight crucibles and placed in the furnaces; the grade of the lead depends upon the amount of clay used in mixing and the quality of the plumbago. The coloring of the lead is by various pigments. The wood, after being thoroughly seasoned, is cut into thin strips and then dried again, then cut into strips pencil length. These strips are grooved by machinery, then carried on a belt to the gluing room, where the lead is placed in the groove, and the other half of the pencil glued on. After being dried under pressure, they are sent to the turning-room and rounded, squared, or made octagon by a very ingenious little machine, which passes them through three cutters and drops them ready for polishing or coloring—the former is done on lathes by boys, and the latter by a machine which holds the brush and turns the pencils fed to it through a hopper. After the pencil is polished, it is cut the exact length by a circular saw, and the end is cut smooth by a drop knife, the pencil resting on an iron bed. The stamping is done by a hollow die, which is heated; the gold or silver foil is then laid on the pencil, which rests on an iron bed, and the die is then pressed on it by a screw lever.

Steel Pens.—First the steel is rolled into big sheets. This is cut into strips about three inches wide. These strips are annealed; that is, they are heated to a red heat and permitted to cool very gradually, so that the brittleness is all removed and the steel is soft enough to be easily worked. Then the strips are again rolled to the required thickness, or rather thinness, for the average steel pen is not thicker than a sheet of thin letter paper. Next, the blank pen is cut out of the flat strip. On this the name of the maker or of the brand is stamped. Next, the pen is molded in a form which combines gracefulness with strength. The rounding enables the pen to hold the requisite ink and to distribute it more gradually than could be done with a flat blade. The little hole which is cut at the end of the slit serves to regulate the elasticity, and also facilitates the running of the ink. Then comes the process of hardening and tempering. The steel is heated to a cherry-red and then plunged suddenly into some cool substance. This at once changes the quality of the metal from that of a soft, lead-like substance to a brittle, springy one. Then the temper of the steel must be drawn, for without this process it would be too brittle. The drawing consists of heating the pen until it reaches a certain color. The first color that appears is a straw color. This changes rapidly to a blue. The elasticity of

the metal varies with the color, and is fastened at any point by instant plunging in cold water. The processes of slitting, polishing, pointing and finishing the pen are operations requiring dexterity, but by a long practice the workmen and workwomen become very expert. There have been few changes of late years, and the process of manufacture is much the same that it was twenty years ago, and the prices are rather uniform, ranging from seventy-five cents to four dollars a gross, according to the quality of the finish.

Needles.—Needles are made from soft steel wire, which is received from the manufactory in coils. The wire is cut by fixed shears into length sufficient to make two needles. These blanks, being bent, require straightening, which is done by placing several thousand of them between two broad heavy rings, and heating them to redness in a furnace. They are then removed and placed, still in position within the rings, on a flat iron plate, and by means of a curved bar, termed a smooth file, rolled back and forth until perfectly straight. Each piece is then sharpened at both ends. The workman takes up a number at a time and holds the ends against a grindstone, forming the points. By means of a die and counterdie, two grooves are stamped by a press on each side of the wire, which is next pierced under a press with two holes forming the eyes. A number of pieces are then strung on two fine wires and broken each in two by filing and bending. The roughness about the head is removed by filing, several at a time being placed in a small vice. During these processes the needles, having become somewhat bent, are straightened by rolling on a flat plate, as before. They are now brought to a red heat, and tempered by plunging them into oil. Fifty thousand at a time are then put in a canvas bag with emery, oil, putty-powder, and soft-soap, and rolled to and fro under pressure until they become bright. The better class of needles have their eyes drilled. The final process is polishing the points, which is effected first by a rotating hone, and afterward by a buff-wheel. Of late years machines have been introduced by which needles are formed from the roll of wire without the intervention of hand labor.



MANUFACTURE OF NEEDLES.—DRILLING THE EYES.

Kid Gloves.—The best skins generally come from middle and southeastern France. Fine seasons improve the quality of the skin greatly, as the animals are kept in the open air. In wet weather it is necessary to keep the kids housed. The pelt, as taken from the animal, is dried; then, through a series of baths, the hair and grease are removed, and the skin cleaned thoroughly. A most difficult stage of the business is tanning and dyeing

the leathers, so much skill being requisite to obtain the desired shades and colors. This is accomplished with the best success in France, as the French possess the art of leather-dyeing to a degree not yet attained by other nations. In order afterward to make the skin soft, full and flexible, it is fed with—actually absorbing quite a quantity of—a preparation of eggs, flour and egg-yelks. Subsequently the parts around the neck and shoulders, where the skin is thickest, are shaved with a sharp knife to render it uniform in thickness throughout. The leather fully prepared is carefully examined for imperfections; perfect skins are retained, imperfect ones laid aside. The cutting of material for kid gloves can only be done by hand, each piece being carefully measured in order to allow the proper stretching space. The stamping, which comprises cutting out the form of the glove, is done by machinery rapidly, as three pairs are usually stamped at one time. From the cutter they pass to the embroiderer, thence to the sewer, then to the button-hole maker, afterward to the finisher, who binds the wrist, and finally to the person whose business is to pair and press them. The long *mosquetaire* gloves generally consume the entire skin of one kid.

Tacks.—Described in a few words, the process of making tacks is as follows: The iron, as received from the rolling mills, is in sheets from three inches to twelve inches wide and from three feet to nine feet in length, the thickness varying, according to the kind of work into which it is to be made, from one-eighth to one thirty-second of an inch. These sheets are all cut into about three-foot pieces, and by immersion in acid cleaned of the hard outside flinty scale. They are then chopped into strips of a width corresponding to the length of the nail or tack required. Supposing the tack to be cut is an eight-ounce carpet tack, the strip of iron, as chopped and ready for the machine, would be about eleven-sixteenths of an inch thick and three feet long. The piece is placed firmly in the feeding apparatus, and by this arrangement carried between the knives and machine. At each revolution of the balance-wheel the knives cut off a small piece from the end of this plate. The piece cut off is pointed at one end, and square for forming the head at the other. It is then carried between two dies by the action of the knives, and these dies coming together form the body of the tack under the head. Enough of the iron projects beyond the face of the dies to form the head, and, while held firmly by them, a lever strikes this projecting piece into a round head. This, as we have said before, is all done during one revolution of the balance-wheel, and the knives, as soon as the tack drops from the machine, are ready to cut off another piece. These machines are run at the rate of about two hundred and fifty revolutions a minute.

Brass, Etc.—Brass is a compound metal, or, as it is properly called, an *alloy* of copper and zinc; it was well known in the earlier stages of the arts, long before pure zinc was discovered, being made of copper and calamine stone, which is an ore of zinc. The manufacture of brass is said to have been introduced into England in 1649 by a German who settled at Esher in Surrey. Good brass is of a fine yellow color, ductile and very malleable when cold; when heated it is brittle, being in this respect a curious contrast to the zinc of which it is partially composed. Brass is the most convenient metal for making large fine screws, astronomical instruments, microscopes, and many other things requiring great exactness; as, notwithstanding its compactness of texture, it is easily wrought at the lathe. Britannia metal is composed of block tin, a small portion of antimony, and less than one-third

as much copper or brass. This compound, which is bright and silvery-looking, is now extensively used instead of pewter, and for many purposes to which pewter was never applied. It is very easy to work, both by rolling, casting, turning, and planing, as well as by stamping in dies; consequently, the articles made of it are almost unlimited in variety, and very cheaply produced; teapots, candlesticks, and spoons are among some of the most frequent applications of this metal. Pewter is a dull-looking alloy, used for making plates and dishes, beer measures, and larger vessels. For the first purpose it has very much gone out of use, being superseded by earthen ware; but in former times all houses were supplied with pewter articles, and no small portion of the "plate," belonging to the wealthy, was of this material. Good hard pewter is made of tin, copper, and antimony; but a very inferior kind, and that most frequently met with, is made chiefly of lead, with a very small proportion of tin and copper in addition.

Sulphur.—Sulphur is a solid non-metallic mineral known from the remotest antiquity; it is hard, yellow, brittle, and has a disagreeable smell. Sulphur is found native in veins or beds mostly near active volcanoes; it is also found combined with iron, copper, lead, and antimony, forming the most abundant ore of those metals. Native sulphur is found massive, powdery, or cellular, and not unfrequently in large crystals, some of which measure four inches in length. Sulphur abounds in the mineral kingdom, but traces of it are found in both the vegetable and animal kingdoms. The bad smell of some plants, as asafetida and garlic, is to be attributed to the sulphur they contain; it exists too in eggs and some other animal products; thus it is that eggs discolor silver spoons. The native sulphur imported comes mostly from Solfatra in Sicily, but large quantities are procured from iron and copper pyrites. These minerals are heated, and the sulphur being volatile flies off in fumes which are conveyed by pipes to a condensing room. If left in the powdery state in which it condenses it is called flour of sulphur; but, if melted and cast it makes roll sulphur. It is used in bleaching, for making gunpowder and matches; it is also used in medicine. One of the combinations of sulphur, *sulphuric acid*, called in commerce vitriol, is so largely used in the arts and manufactures, that it has been said the commercial prosperity of a country may be fairly estimated by the amount of sulphuric acid it consumes.

Slate Pencils.—In making slate pencils broken slate is put into a mortar run by steam and pounded into small particles. Then it goes into a mill and runs into a "bolting" machine, such as is used in flouring mills, where it is "bolted," the fine, almost impalpable flour that results being taken to a mixing tub, where a small quantity of steatite flour similarly manufactured, is added together with other materials, the whole being made into a stiff dough. This dough is thoroughly kneaded by passing it several times between iron rollers. Thence it is conveyed to a table where it is made into "charges," or short cylinders, four or five inches thick and containing eight to twelve pounds each. Four of these are placed in a strong iron chamber or "retort," with a changeable nozzle so as to regulate the size of the pencil, and subjected to tremendous hydraulic pressure under which the composition is pushed through the nozzle in the shape of a long cord, and pass over a sloping table slit at right angles with the cords to give passage to a knife which cuts them into lengths. They are then laid on boards to dry, and after a few hours are removed to sheets of corrugated zinc, the corra-

gation serving to prevent the pencil from warping during the process of baking, to which they are next subjected, in a kiln, into which superheated steam is introduced in pipes, the temperature being regulated according to the requirements of the article exposed to its influence. From the kiln, the articles go to the finishing and packing room, where the ends are thrust for a second under rapidly revolving emery wheels, and withdrawn neatly and smoothly pointed. They are then packed in pasteboard boxes, each containing one hundred pencils, and these boxes are in turn packed for shipment in wooden boxes, containing one hundred each, or ten thousand pencils in a shipping box. Nearly all the work is done by boys.

Rubber Boots.—The gum used is imported directly from Africa, South America, and Central America, that from Central America being best, while the African gum is the poorest. The raw gum, which is nearly white, is ground several times between immense fluted iron rollers, after which it passes through the composition room, which process is secret, but when it comes out, the gum has the black appearance of common rubber. The next process is that of passing the rubber between chilled iron cylinders, of many tons weight, which are kept very hot and very smooth. A part of the rubber intended for "uppers," is here spread upon and fastened to long sheets of cloth. The heels and taps are stamped out of sheets of gum of the required thickness. The rubber is now carried to the cutter's room, where it is cut out and sent to the bootmakers. The boots are made by men, the shoes or ordinary rubbers by girls, while the overshoes are made by either. One man will make twelve or fourteen pairs of boots a day, and receive twenty cents a pair. An active girl will make from twenty-five to thirty pairs of rubbers. After the bootmaker is through they are placed in an oven, where for twelve hours they are subjected to a temperature of three hundred degrees. They are then ready for boxing and shipping. In one factory about four thousand pairs of boots, rubbers, and overshoes are turned out daily.

Rubber Balls.—The rubber balls used in games are made in the following manner: The sheets of rubber are cut into strips of double convex shape, or like the rind of an orange. The edges of the strips are moistened with a liquid, made of rubber and naphtha, by which they are joined firmly together. This part of the work is generally done by girls, who soon become skillful workers. When the strips are joined, the ball is about the shape of a Brazil nut. Before the last opening is closed, some carbonate of ammonia is put inside. This causes the rubber to expand and fill out the ball mold. The molds are iron plates of the required shape. The ball is placed in its mold, and then, being heated, is pressed round. Sometimes explosions occur in molding, for rubber has considerable expansive force.

Thimbles.—The manufacture of thimbles is very simple, but singularly interesting. Coin silver is mostly used, and is obtained by purchasing coin dollars. The first operation strikes a novice as almost wicked, for it is nothing else than putting a lot of bright silver dollars, fresh from the mint, into dirty crucibles, and melting them up into solid ingots. These are rolled out into the required thickness, and cut by a stamp into circular pieces of any required size. A solid metal bar of the size of the inside of the intended thimble, moved by powerful machinery up and down in a bottomless mold of the outside of the same thimbles, bends the circular disks into the thimble shape as fast as they can be placed under the descending bar.

Once in shape, the work of brightening, polishing, and decorating is done upon a lathe. First, the blank form is fitted with a rapidly revolving rod. A slight touch of a sharp chisel takes a thin shaving from the end, another does the same on the side, and the third rounds off the rim. A round steel rod, dipped in oil, and pressed upon the surface, gives it a lustrous polish. Then a little revolving steel wheel, whose edge is a raised ornament, held against the revolving blank, prints that ornament just outside the rim. A second wheel prints a different ornament around the center, while a third wheel, with sharp points, makes the indentations on the lower half and end of the thimble. The inside is brightened and polished in a similar way, the thimble being held in a revolving mold. All that remains to be done is to boil the completed thimbles in soapsuds, to remove the oil, brush them up, and pack them for the trade.

Crackers.—Inspecting one of the largest bakeries in New York City, a visitor found a praiseworthy cleanliness in every part. On the second floor of the building there are five “reel” or cylinder ovens. These ovens, about twenty feet in diameter, have the fires at the bottom, and above the fire is a large wheel or cylinder. On the outer frame of this wheel are ten swinging trays. On these trays the crackers, as they are turned out from the stamping machine close by, are placed, and the wheel revolves slowly, lowering the next tray into position. Thus the wheel is kept in constant motion, the biscuit being removed from the trays after making one revolution of the cylinder.

In this bakery the weekly supply of materials is six hundred barrels of flour, three thousand pounds of butter, twenty thousands pounds of lard, eighty barrels of sugar, twenty-five barrels of molasses, fifteen barrels of currants, together with eggs, honey, cornstarch, and other necessary ingredients.

The mixing of the dough, the rolling and the stamping, are done by machine. The mixing machine is on the second floor of the building. One shoot leading into this mixer, which is a large wooden cylinder, supplies the proper proportion of flour; another supplies the milk, another the sugar, another the water, etc.

In the mixer there are three spoons or bars revolving alternately, which thoroughly mix the dough. It is then taken to the floor above, where a row of boxes is placed, in one of which the dough is put to “rise.” When ready for baking, it is taken again to the floor below, unless it is to be used in making soft crackers. Here it is placed on large trays, and as the workmen knead it they slice off large pieces of the dough and place it in a rolling machine. It is rolled four or five times until it becomes of the proper thickness, and it is then placed on the cracker-making machine. Before reaching the die it is passed beneath another roller, and at either side of the tray on which it is placed are knives, which trim it to the proper shape. From the roller the sheet of dough runs under the die, which cuts out the crackers, and at the same time stamps the name or other device and makes the “pin-holes.”

In stamping square crackers, such as soda-biscuits, there is but little waste; but in cutting out other shapes fully one-half of the dough is not used. The finished shapes and waste material are passed upon a cloth roller, an iron bar with a toothed edge being so set, at a short distance from the die, that, as they pass upon another cloth band, the crackers are pushed down upon the original roller, being thence carried to

the end of the machine, where they fell upon the trays, which, as soon as they are full, are put upon the swinging shelves in the "reel" oven. The "trimmings" are taken up and again passed through the machine. This same plan is pursued in making all hard crackers, the quantity and kinds of ingredients, together with the flavoring used, varying according to the special variety to be made from the dough.

On the third floor the soft crackers, such as macaroons, lady fingers, butter-scotch, honey cake, etc., are made. Four mixers for the dough of which these are made are placed on this floor. These goods are baked in square ovens.

Some of the finer varieties of crackers are made by hand, but others, even of these, are made by ingeniously contrived machines. The visitor stood by and saw the method of making "cocoanut drop cake." A tray placed in a machine moved under an upright receptacle filled with the soft dough forming the body of the cake. This was fed through five or six holes, slowly dropping upon the pan. Another man then took the pan, and, turning it upside down, pressed the soft cakes upon a surface of desiccated cocoanut spread on a sheet resting upon water in a tank. The cakes were then placed in one of the square ovens, and in less than five minutes the visitor had positive knowledge that a cocoanut drop cake is a delicious morsel.

The fruit for fruit-crackers, the visitor was assured, is the best quality of dried currants. They are washed and dried, and are then carefully picked over by boys, and all imperfections removed. To make fruit-crackers, the process is much the same as with other hard crackers. One of the newest and most peculiar designs is the "charcoal" cracker, in which a small proportion of charcoal is mixed with dough. This variety is in demand by dyspeptics, as are also oatmeal and graham crackers.

Sardines.—These little finny creatures are caught in nets, and after being well washed the heads are cut off and the fish are sprinkled lightly with fine salt. After lying for a few hours they are placed on girds in rows almost perpendicular. The frames are then placed in pans containing boiling olive oil. This oil is changed as often as it becomes too black and dirty for continuing the cooking process. As soon as the fish are considered sufficiently cooked they are withdrawn from the pans of oil, and the girds are placed on tables covered with zinc, the surface of the tables inclining toward a groove in the center. The oil is thus carried to a vessel prepared to receive it. Around these tables stand the women whose business it is to pack the fish closely and uniformly in boxes. The boxes being full, the fish are covered with fresh oil, and the lids of the boxes are then soldered down. Thus hermetically sealed they are placed in a wire basket and immersed in boiling water. The smaller boxes are thus boiled for about an hour, and the larger ones somewhat longer, in proportion to the size of the box. The fish are then ready for the market, and being packed in cases, are sent to the ends of the earth.

Shoe Pegs.—The timber used in the manufacture of shoe pegs is black and yellow birch, which is cut into pieces four feet in length, varying in diameter from eight to fourteen inches, and again cut into slices or blanks of the thickness desired for the length of the pegs. These are sorted and the knots cut out, and are then passed on to a long bench containing machines composed of fluted rollers. The blanks are then run between these

rollers, which crease on both sides. They are then run through again to cross crease, or mark out the exact sizes of the pegs. They then go to the splitting machines, which are set with double knives, and cut the blanks into pegs. As they pass the last machine they are sorted, and all knots and discolored ones removed as they are brushed off into large baskets. The next process is bleaching, which is accomplished by the fumes of brimstone. They are then placed in large cylinders, which hold eleven barrels, and have six hundred steam pipes running through them, and revolve one and one-half times to the minute, drying two charges per day to each cylinder. They are then passed into large wooden casks, or cylinders, which, revolving rapidly, polish them by the friction, the refuse falling through wire sieves or screen openings, after which they are again passed into a sifter, which separates all the single pegs and drops them into tubs or boxes, leaving those which have not been separated in the machine. They are then put in barrels ready for market.

Cashmere Shawls.—The greater part of the wool for these exquisite fabrics, and we refer to the true cashmere shawls, is supplied not only from the Cashmere Valley, but from Thibet and Tartary—the cashmere goat being distributed over certain portions of Central Asia. It is only the summer wool that is used, and this is bleached by a preparation of rice flour. On plain shawls, the weaving is effected by a long, heavy and narrow shuttle, but this is superseded by wooden needles when the more ordinary variegated shawls are to be made. For each colored thread, a different needle is used. So slow is the process when the design is elaborate, that the completion of a square inch will occupy three persons for a day, and a shawl of remarkable beauty would take this number a year for its execution; but a number are engaged on the same shawl, according to the speed required. Singularly enough, it is only the inner side of the shawl that is exposed to the view of the workman, he being guided by the design placed before him and the directions of a skilled supervisor of the work. The thread is previously spun and dyed by women. The shawl worked with the needle is, however, far inferior to that in which the pattern is woven in. Sulphur fumes are employed to give the shawls the beautiful yellow color so much in request in the East.

Sealskin Sacques.—Few of those wearing a sealskin sacque have any knowledge of the process by which the skins are prepared for use. Seen when first taken from the animal they little resemble the warm, glossy skins worn upon our streets, for until dyed and cured they are of a light brown hue, coarse and full of sand. Before becoming valuable they are shaved down on the flesh side until not thicker than paper, the long hairs are pulled out and the fur dyed. The cost of the article is due to the labor expended upon it. The raw skins are sold in London, where the finishing is done, and then shipped back to America, where they are sold with a heavy duty added. The killing season in Alaska begins about the 12th of June, and the one hundred thousand skins are usually ready for shipment a month later. The work of slaughtering the animals is done by natives who live upon the St. Paul and St. George Islands, and the process is an interesting one. When skins are wanted, the natives go to the rookeries, station themselves along the shore, between the seals and the water, and, at a given signal, spring to their feet and make as much noise as possible. The frightened victims, timid as deer, then stampede up the beach, and are

driven like sheep a few miles inland until their captors attack them with hickory clubs. Being knocked senseless, they are stabbed with long sharp knives, and the skins are quickly stripped from the bodies.

Matches.—Large planks are cut up into blocks, double the length of the match, and put one at a time upon the cutting machine. Two large knives, converging at the points, are driven back and forth upon the block, and numerous little clamps beneath, wide enough apart to pass one match between, are pressed up, each taking off a match at every passage of the knives, at the rate of sixty a minute. The particles are packed in square frames and placed in a kiln dryer, over the furnace, where they remain twenty-four hours. They are taken out, and by means of curious machines are coiled upon an ordinary cotton band. On each coil there is a gross, or one hundred and forty-four matches, and the band is between each layer. A curious arrangement of the machine is, that it will coil nothing but a perfect match, and throws the defective ones aside. The coiling is slow, and and one man can tend five machines, which will ordinarily coil about one hundred and fifty gross per day. After the coil is made up, the ends are planed down even and put upon a hot iron, which opens the pores of the wood. Both ends are then dipped into melted brimstone, into a composition of phosphorus, glue and other materials, and hung upon racks for ten minutes, at the end of which they are dry. The coils are then unrolled, the matches put in the square frame, cut in two in the middle, boxed and packed ready for shipment. The boxing is mostly done by boys and girls.

Mirrors.—Looking-glasses used to be made by covering the plate with an amalgam of tin and mercury; but this has been superseded by depositing a coat of real silver upon the glass, thrown down in a smooth film by adding oil of cloves or other organic substances to a solution of ammoniac-nitrate of silver, retained upon the plate by a raised rim of wax. The trouble with the process has been that, though cheaper, the plates are inferior in luster, and lack the "black" color which silversmiths regard as indicating perfection of polish. The long-looked-for process of imparting the brilliancy of the mercurial coating to the cheap and durable film has at last been accomplished by chemical reaction. After the silver plating is complete the film is flooded with a weak, aqueous solution of the double cyanide of mercury and potassium; slow decomposition takes place, and the mercury is precipitated, which immediately amalgamates with the silver film. The result is said to be thoroughly satisfactory, the amalgam of silver being quite as brilliant as that of tin, and less subject to change, while the new process has the advantage of being readily applicable to the largest plates, which by the old method could be treated only with great difficulty, if at all.

Combs.—One of the greatest comb manufactories in the world is in Aberdeen, Scotland. In this establishment there are an immense number of furnaces for preparing horns and tortoise shells for the combs, and between one and two hundred iron screw-presses are constantly employed in stamping them. Steam power is employed to cut the combs, the operation being performed by this means with great efficiency. The coarse combs are stamped or cut out, two being cut in a piece at one time by ingenious machinery. The fine dressing-combs and all small-tooth combs are cut by fine circular saws, some so fine as to cut forty teeth in the space of one inch, and they revolve thousands of times in a minute. There are about two thousand varieties of combs made, and the aggregate number produced, of all these

different sorts of combs, is about nine millions annually. The annual consumption of ox-horns, hoofs, tortoise shell and buffalo horn is, of course, prodigious; even the waste, consisting of horn shavings and partings of hoofs, amounts to hundreds of tons in a year, and this becomes a valuable material in the manufacture of prussiate of potash, etc.

Soda.—Soda is an alkali which was formerly obtained in large quantities from the ashes of kali and various other marine plants growing on the shore of the Mediterranean Sea, and to which ashes the name of barilla is given; a more impure soda was obtained from kelp, which is the ashes of different sea-weeds found on the coasts of Ireland and Scotland; a large trade was formerly carried on in these articles, but it is now found cheaper to make soda by the decomposition of salt. The salt is put into a furnace, and sulphuric acid poured upon it; the heat first melts it, and then roasts it into sulphate of soda, or *salt-cake*, as it is called; this is afterward put into another furnace with an equal weight of carbonate of lime, either in the form of limestone or chalk, and half its weight of small coal; the whole is subjected to intense heat, during which many chemical changes take place. The mass, when finally raked out to cool, consists of black ash and ball soda, or British barilla; it is afterward separated from insoluble impurities by being dissolved in warm water; and, after being further purified in the furnace, becomes the soda of commerce, which is in fact carbonate of soda.

Isinglass.—One of the most notable industries of Russia depends upon the sturgeon, the swim-bladder of which is manufactured into isinglass. The bladder is first placed in water, and left there for some days, with frequent changes of the water, and removal of all fatty and bloody particles, the warmer the water the more rapid being the operation. The bladders, on being removed, are cut longitudinally into sheets, which are exposed to the sun and air, being laid out to dry, with the outer face turned down, upon boards of lime-tree wood. The inner face is pure isinglass, which, when dried, can be removed from the external lamellæ. The inner sheets thus obtained are placed between cloths to keep them from flies, and are then subjected to a heavy pressure, so as to flatten them out and render them uniform; and after this they are assorted and tied in packets. The packets composed of the isinglass of the large sturgeon usually contain from ten to fifteen sheets, and weigh a pound and a quarter; and those of others contain twenty-five sheets, weighing a pound. Eighty of these packages are usually sewed up in a cloth bag or enclosed in sheet lead.

Marbles.—The chief place of the manufacture of marbles—those little pieces of stone which contribute so largely to the enjoyment of boys—is at Oberstein, on the Nahe, in Germany, where there are large agate mills and quarries, the refuse of which is turned to good paying account by being made into small balls, employed by experts to knuckle with, and are mostly sent to the American market. The substance used in Saxony is a hard, calcareous stone, which is first broken into blocks, nearly square, by blows with a hammer. These are thrown by the hundred or two into a small sort of mill, which is formed of a flat, stationary slab of stone, with a number of eccentric furrows upon its face. A block of oak or other hard wood of the diametric size, is placed over the stones and partly resting upon them. The small block of wood is kept revolving while water flows upon the stone slab. In about fifteen minutes the stones are turned into spheres, and then, being fit for sale, are henceforth called marbles.

One establishment with but three mills, turns out sixty thousand marbles each week.

Lace.—Lace is a species of net-work made of silk, thread, or cotton, upon which, in old times, patterns were embroidered by the needle after its construction. They are now, for the most part, formed during the knitting itself. The best laces are made at Mechlin, Brussels, Antwerp, Ghent, and Valenciennes. Point lace is that embroidered by the needle and, from the great labor required, is the most expensive. In lace knit by hand as many threads are employed as the pattern and breadth require. These are wound upon the necessary number of bobbins made of bone (whence the name bone-lace), which are thrown over and under each other in various ways, so that the threads twine around pins stuck in the holes of the pattern (a stiff parchment stretched on a pillow), and by these means produce the openings which give the desired figure. In that made by machinery, the meshes are all formed by a continuation of a single thread.

Amber.—The following facts in regard to this substance will interest curious readers: Amber is the fossil resin produced by upward of six kinds of coniferous trees in prehistoric times. Two of these trees, of which immense forests covered the regions now producing amber, have been proved to be nearly related to the existing Weymouth pine and the modern fir-tree. While the wood of the trees rotted away, the resin oozed out of the stem of the tree as well as out of the roots, and was deposited eventually in immense quantities in the soil. In some of the pieces of the amber, bits of the wood and bark of the trees are found imbedded, and through this lucky accident have been preserved from decay. On examining this wood with the microscope, it is at once apparent that the trees were as intimated above, closely related to our modern coniferæ, but were not absolutely identical with any of the existing species. Ages ago, the whole region now covered by the eastern part of the Baltic Sea was covered by these amber-producing trees. The largest European amber deposits are found on the Baltic shores of Northeastern Prussia. There, about eighty tons a year are at present dug up, and the supply appears practically inexhaustible.

Celluloid.—Celluloid is a composition of fine tissue paper and camphor, treated with chemicals by a patented process. A rather common impression that it contains gun-cotton is a mistake, which arises from confounding it with collodion. Celluloid, it is said, is entirely non-explosive, and burns only when in direct contact with flame. When crude it looks like transparent gum, and its color is a light yellow-brown. It can be made as hard as ivory, but is always elastic, and can be molded into any conceivable form. With equal ease it can be colored in any tint desired, the dye running through the entire substance, and being therefore ineffaceable. It can also be mottled to imitate the finest tortoise-shell. It is largely used in the manufacture of combs, hair brushes, hand mirrors, jewelry, knife handles, collars, cuffs, and many other articles.

Clothes Pins.—Insignificant as the common wooden clothes pin is in itself, its manufacture forms no mean part in American industries, and the numerous factories in the New England and other States furnish employment to thousands of persons. Beech, white birch, and poplar are the woods used in making the article, the birch and poplar being considered the best. The machinery employed is very simple. The wood is first sawed in

logs four feet in length and then cut into small square sticks by means of a cutting machine. Each stick, after being rounded in a lathe, is passed into another machine, which throws out a number of perfectly formed pins at one cut and with great rapidity. The pins are then thrown into a large revolving cylinder and smoothed by friction with each other.

Screws.—The process of making a screw is very interesting. The rough, large wire in big coils is, by drawing through a hole smaller than itself, made the size needed. Then it goes into a machine that at one moment cuts it a proper length, and makes a head on it. Then it is put into sawdust and “rattled,” and thus brightened. Then the head is shaved down smoothly to the proper size and the nick put in at the same time. After “rattling” again in sawdust the thread is cut by another machine, and after another “rattling,” and thorough drying, the screws are assorted by hand (the fingers of those who do this move almost literally like lightning), grossed by weight, and packed for shipping. That which renders it possible for machines to do all this is a little thing that resembles and opens and shuts like a goose’s bill, which picks up a single screw at a time, carries it where needed, holds it until grasped by something else, and returns for another.

Whalebone.—Whalebone represents an enormous development of the gum of the whale, and exists in the living animal in the form of two rows of plates, which, like a great double fringe, hang or depend from its palate. From one hundred and fifty to two hundred of these plates exist in the mouth of a whale, and the largest plates may measure from eight to ten or twelve feet in length. The inner edges of these whalebone plates exhibit a fringed or frayed-out appearance, and the whole apparatus is adapted to serve as a kind of gigantic sieve or strainer. Thus, when the whale fills the mouth with water, large numbers of small or minute animals, allied to jelly-fishes and the like, are engulfed and drawn into the capacious mouth cavity. The water is allowed to escape by the sides of the mouth, but its solid animal contents are strained and entangled by the whalebone fringes, and when a sufficient quantity of food has been captured in this way, the morsel is duly swallowed.

Spools.—The birch from which spools are made is first sawed into sticks four or five feet long and seven-eighths of an inch to three inches square, according to the size of the spool to be produced. These sticks are thoroughly seasoned. They are sawed into short blocks, and the blocks are dried in a hot-air kiln. At the time they are sawed a hole is bored through them. One whirl of the little block against sharp knives, shaped by a pattern, makes the spool at the rate of one per second. A small boy feeds the spool machine, simply placing the blocks in a spout and throwing out the knotty or defective stock. The machine is automatic, but cannot do the sorting. The spools are revolved rapidly in drums and polish themselves. For some purposes they are dyed yellow, red, or black. They are made into thousands of shapes and sizes. One factory turns out one hundred thousand gross a day, and consumes two thousand five hundred cords of birch wood annually.

Pins.—A snappish, voracious little dwarf of a machine pulls in the wires, bites it off by inches incessantly, one hundred and forty bites a minute, and just as it seizes each bite a saucy little hammer, with a concave face, hits

the end of the wire three taps, and "upsets" it to a head, while he grips it in a countersunk hole between his teeth, and lays it sideways in a groove, where levers and springs, playing like lightning, point the pins, and whence they are dropped into a box. The pins are then polished, and two very intelligent machines reject every crooked pin. Another automaton assorta half a dozen lengths, and a perfect genius of a machine hangs the pins by the heads and transfers them to slips of paper, and by one movement sticks them all through two corrugated ridges in the paper, when the work is finished. The pin machine is one of the nearest approaches to the dexterity of the human hand that has been invented. It is about the size of a sewing machine, which it closely resembles.

Musk.—Musk, a strong odor procured from the musk-deer, is very largely used in the manufacture of bouquets. It is one of the most powerful perfumes known, and articles on which it is used retain their odor for years. One of the most striking examples of this is illustrated in the Mosque of St. Sophia, in Constantinople, the mortar used in the building of which was impregnated with this substance; and although centuries have elapsed since the building was erected, the scent of the musk is yet plainly discernible. The best musk comes from Tonquin and Thibet, but the deer is found throughout the whole length of the Himalayan chain. The scent is found beneath the skin, and near the navel of the animal, which is not bigger than a grayhound, and is often caught in snares, though it is generally hunted as we do hares.

Shot.—A shot tower is an immense brick structure, one hundred and fifty feet high, resembling a lighthouse more than anything else. Visitors are conducted up a spiral staircase inside to the top, where a fine view is obtained for miles about, but the view down the inside is not so pleasant. The opening where the shot descends becomes narrower and narrower, until nothing is seen at the bottom but darkness. At the top of the tower are the furnaces for smelting. From these lead is poured into pans set in the tower, with perforated sheet-iron bottoms. The melted lead comes through these holes and enlarges on the other side, formed into globules before it falls down to the well beneath holding several feet of water. The large shot drop the whole height of the tower to the bottom, but the smaller sizes only about half as far. One peculiar thing is that smaller shot generally expand in falling, and the larger sizes contract.

Gum Arabic.—After the rainy season in Morocco, a gummy juice exudes spontaneously from the trunk and branches of the acacia. It gradually thickens in the furrow down which it runs, and assumes the form of oval and round drops, about the size of a pigeon's egg, of different colors, as it comes down from the red or white gum tree. About the middle of December the Moors encamp on the borders of the forest, and the harvest lasts a full month. The gum is packed in large leather sacks, and transported on the backs of camels and bullocks to seaports for shipment. The harvest occasion is one of great rejoicing, and the people, for the time being, almost live on the gum, which is nutritious and fattening.

Putty.—The best putty is made of raw linseed oil and whiting, the latter being simply chalk, ground in a mill like flour. It comes out with a fine flint grit in it. Before making putty out of it a few old-fashioned men, who believe in making the best of everything, wash the grit out. The fine

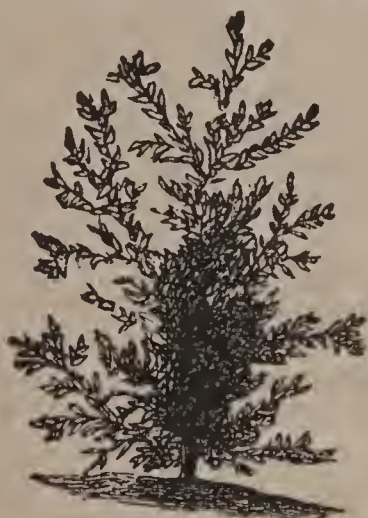
flour is then dried. If it is not dried perfectly it takes up more oil than is desirable or profitable. From five hundred to six hundred pounds—about fifteen per cent. by weight of raw oil to eighty-five per cent. of whiting—are put in a chaser and thoroughly mixed. The chaser is a circular trough, ten feet in diameter. From a vertical shaft in the center two arms extend, on the ends of which are heavy iron wheels that rest in the trough. When the shaft revolves the wheels chase each other around the trough. When mixed it is packed in bladders for convenience in handling.

Buttons.—In making metal buttons, circular disks, called “blanks,” are first cut out of sheet brass or other metal by means of fly-presses, usually worked by girls. The fly-press consists of a vertical iron screw with a triple thread, to which screw is attached a horizontal arm, bending downwards at the end to form a handle. A punch attached to the press rises and falls with the motion of this handle, and rapidly cuts out the blanks. When large quantities of one pattern are required, a self-feeding, self-acting machine is used, which cuts out the blanks in rows at one blow, turning them out at the rate of two thousand gross per day. After being annealed, the blanks are next made convex by a blow from a stamp. The shanks are formed of wire by a separate machine, which cuts off pieces, and bends them into loops of the required form. When these are soldered on, the buttons are dressed on a lathe. They are then gilded and burnished; some, however, are only lacquered; and some, though gilt, are finished in a dead or frosted style. Buttons with holes, technically called “four-holes,” “three-holes,” and “two-holes,” when of pearl shell, wood, bone, or ivory, are cut with a tubular saw, turned separately in a lathe, and drilled. When of metal, the blanks are punched, then stamped in dies to the required form; the holes are punched, and “rymered” to round the sharp edges that would otherwise cut the thread. Glass buttons are most largely made by taking a rod of glass of any color, softening the end by heat, and pressing it into a mold, each half of which is fixed to one limb of a pair of pincers. The shank is placed into a hole in the mold before the melted glass is inserted.

Chewing Gum.—Forty thousand dollars' worth of chewing gum is gathered in the State of Maine every year. The gum is found chiefly in the region about Umbagog Lake and about the Rangely lakes. A number of men do nothing else in the winter season except collect gum. With snowshoes, ax, and a sheboygan, on which is packed the gum, they spend days and nights in the woods. The clear, pure lumps of gum are sold in their native state, the best bringing one dollar per pound. Gum not immediately merchantable is refined by a peculiar process. Sieve-like boxes are covered with spruce boughs, on which is placed the gum. Steam is introduced underneath. The gum, as melted, is strained by the boughs, and then passes into warm water, where it is kept from hardening until the packer takes it out, draws it into sticks, and wraps it in tissue paper, when it is ready for market.

TREES, PLANTS, FRUITS, ETC.

Tea.—Tea is composed of the leaves of a shrub grown chiefly in China, and Japan, of which countries it is a native. It is an evergreen, grows to the height of from four to six feet, and bears pretty white flowers, resem-



TEA-PLANT, FLOWER AND LEAF.

bling the wild rose. There are several varieties of the tea plant; those most cultivated are *Thea bohea* and *Thea viridis*; it was formerly believed that these two plants yielded the black and green teas, and from this belief they derived their names; but it is now proved that the difference arises in the mode of preparing, and that either kind of tea can be made from either plant without any difficulty.

In China there are great numbers of tea-farms, generally of small extent, situated on the upper valleys, and on the sloping sides of the hills, where the soil is light and rich, and well drained. The plants are raised from seed, and generally allowed to remain three years before a crop of leaves is taken from them, as this operation of course injures their growth; even with care they become stunted, and unprofitable in about eight or ten years. When the crop is ready, the leaves are carefully picked by hand one by one, and

there are usually three or four gatherings in each year, the first crop in the spring being of the most value; a well-grown bush, well treated, will produce two or three pounds of tea annually.

The method of preparation is as follows: For green tea, the leaves are only allowed to dry for an hour or two after gathering, before they are thrown into heated roasting-pans placed over a wood-fire; they are stirred quickly with the hands, and allowed to remain for a few minutes; they are next rolled by hand on a table covered with mats, and afterward roasted and rolled again; the color is by this time set, and the after-processes of sorting and reffring, which, for the finer sorts, are repeated several times, may be deferred to a leisure time. In the preparation of black tea the leaves are allowed to remain a long time, say a whole day, drying, before they are fired; they are tossed about and patted while cooling, and are finally dried over a much slower fire.

The tea is sent from the farms to the coast for exportation, mostly by coolies, who carry the chests over the mountains till they reach some navigable river or canal, by which it can be conveyed to the coast. It is said to be a curious sight to watch, from the top of a wild mountain-pass, long

trains of coolies laden with chests of tea, which they carry on their shoulders or balanced at each end of a bamboo, winding along in one direction, and others returning laden with cotton goods and other merchandise received in exchange.

Tea was first brought to Europe in 1610 by the Dutch East India Company; and it must have been in use in England by the year 1660, as appears from an act of Parliament passed in that year, in which a tax of 1s. 6d. was laid on every gallon of tea sold at the coffee-houses. There is also the following entry in "Pepy's Diary," dated September 25, 1651: "I did send for a



A TEA FARM.

cup of tea (a China drink), of which I had never drunk before." In six years more it had found its way into his own house, as this entry shows: "Home—found my wife making of tea, a drink which Mr. Pelling the potticary tells her is good for her cold," etc. About this time the East India Company ordered "one hundred pounds weight of goode tey" to be sent home on speculation. The price was about fifty or sixty shillings the pound, and two pounds three ounces of the best tea was not deemed an unfitting present from the East India Company to the king. But so greatly has the exportation increased, that now more than fifty thousand tons of shipping are employed in its transportation, while it is consumed at the present moment by

probably not less than five hundred millions of men. Still, so vast is the home consumption that it is alleged that, were Europeans and Americans to abandon its use altogether, the price would not be much diminished in China.

Coffee.—Coffee is the seed of an evergreen shrub, the *Coffea Arabica*, which is said to have been discovered in Abyssinia by the Arabs. It is chiefly cultivated in Arabia, the Southern States of North America, Costa Rica, Brazil, and other tropical portions of South America, the East and



A COFFEE PLANTATION.

West Indies, Java, and Ceylon; but the climate of Arabia, where it was first cultivated, appears to be most suited to its growth; frequent rains, and the brilliant unshaded light of its almost cloudless sky, stimulate vegetation, and cause the secretion of those principles on which depend the delicate aroma.

Elevated situations are most suitable for the growth of coffee, and the plantations have much the appearance of pleasure-grounds. The trees are raised from slips, which are allowed four or five years to grow before they are cropped; they attain the height of eight or ten feet, and continue in

bearing from thirty to fifty years. The shrub or tree resembles a handsome laurel, and bears a profusion of clusters of fragrant white flowers, which are succeeded by brilliant red berries, sweet and pulpy, which ripen to a purple color—each containing two coffee-seeds, or stones.

The process of preparing coffee for market, says a writer in *Scribner's Magazine*, is as follows: The ripe berries when picked are at first put through a machine called the "despulpador," which removes the pulp; the coffee grains are still covered with a sort of glutinous substance which adheres to the bean; they are now spread out on large "patios," made specially for this purpose, and left there, being occasionally tossed about and turned over with

wooden shovels until they are perfectly dry. They are then gathered up and put into the "retrilla," a circular trough in which a heavy wooden wheel, shod with steel, is made to revolve, so as to thoroughly break the husk without crushing the bean. The chaff is separated from the grain by means of a fanning-mill, and the coffee is now thoroughly dry and clean. After this, it is the custom of some planters to have it spread out on long tables and carefully picked over by the Indian women and children, all the bad beans being thrown out. It only remains then to have it put into bags, weighed and marked, before it is ready for

shipment to the port. On some of the larger plantations this process is greatly simplified, with considerable saving in time and labor, by the use of improved machinery for drying and cleaning the coffee.



THE CACAO TREE.

Cocoa and Chocolate.—Cocoa is the bruised seed of various species of *theobroma*, a tree which grows wild in the West India Islands, Brazil, and various parts of Central America, where it is generally found growing at the height of six hundred feet above the level of the sea. The cocoa, or, as it should be written, *cacao*, tree is an evergreen, and is said to bear some resemblance to a young cherry-tree; the leaves are large and simple, the

flowers grow in clusters, the pods are not unlike cucumbers in form, and of a yellowish red color; they contain from twenty to thirty nuts, about the size of large almonds, violet, or ash-gray colored, and containing each two lobes of a brownish hue. A wet soil is needful in cultivation, and the plants also requiring shade, they are generally placed between rows of large trees, which render the plantations very charming spots in tropical regions; the plants are raised from seed, and are seven or eight years in coming to perfection, but require so little attention that one man can superintend one thousand plants; the usual times of gathering the crop are in June and December, and not more than one pound and a half of seeds is the average produce of each plant. The fruit of the wild plants is frequently gathered. In preparing the cacao for market, the seeds, after being freed from the pod, are dried either in the sun or by artificial heat; they are then either simply bruised, which makes cocoa-nibs, or crushed between rollers, which makes flake cocoa; or they are ground and made into a paste, in which state they are very often adulterated.

Chocolate is so called from *chocolalt*, the Mexican name for the cacao-tree. The produce of several of the finest kinds is not exported; the best that reaches us is from Caraccas, Guatemala and Berbice. The method of preparation is as follows: The cacao-beans are gently roasted, shelled and reduced to a paste, when vanilla, cloves, cinnamon, rice, almonds, or starch, etc., are frequently added to it; it is put into molds, and always improves by keeping.

Cotton.—Cotton is a downy substance produced on the seeds of the cotton plant, *Gossypium*, which is herbaceous, and of a height varying from four to twenty feet, according to the species; it has downy lobed leaves, and flowers similar in form to those of the common mallow, to which it is related; in some species the flower is yellow, and in others of a dull purple color. The seed-vessel is a capsule, which opens into from three to five lobes, and shows the seeds, which are quite covered with cotton; in some cases this is of a bright buff color, and sometimes it is white. Plants are often covered with hairs in different parts, some having downy stalks, and some downy leaves like the mullein; but it is remarkable that hairs on the seeds are not at all common, being in fact very much confined to those plants which are allied to the cotton-plant. The cotton-plant seems to have been indigenous in both the Old World and the New; it has been known in India from time immemorial, and still grows wild in many parts. When the Spaniards first landed in America they found it growing wild there; the species native to the different continents are very dissimilar; but both are grown in the present day in India as well as in America. Dr. Livingstone, the great modern discoverer, in describing the new land he has brought to light in Central Africa, says that both cotton and indigo grow wild over the face of the country, which appears eminently fitted for their cultivation.

In every mode of spinning cotton the ends to be accomplished are, to draw out the loose fibres of the cotton-wool in a regular and continuous line, and after reducing the fleecy roll to the requisite tenuity, to twist it into a thread. Previous to the operation of spinning, the cotton must have undergone the process of carding, the effect of which is to comb out, straighten and lay parallel to each other its entangled fibres. The cotton was formerly stripped off the cards in loose rolls, called cardings or slivers, and the only difference between the slivers produced by the old hand-cards and those produced by the present carding engine is, that the



THE COTTON PLANT.

former were in lengths of a few inches, and the latter are of a length of some hundreds of yards. Let it be remarked that the sliver of carding re-

quires to be drawn out to a considerably greater fineness before it is of the proper thickness to be twisted into a thread. The way in which this is now accomplished is by two or more pairs of small rollers placed horizontally, the upper and lower roller of each pair revolving in contact; the sliver of cotton being put between the first pair of rollers is, by their revolution, drawn through and compressed; whilst still passing through these rollers, it is caught by another pair of rollers placed immediately in front,



PICKING COTTON.

which revolve with three, four or five times the velocity of the first pair, and therefore draw out the sliver to three, four or five times its former length and degree of fineness. After passing through the last pair of rollers the reduced sliver is attached to a spindle and fly-wheel, the rapid revolutions of which twist it into a thread, and at the same time wind it upon a bobbin. It is manifest that, by increasing the length of roller and the number of slivers, a hundred or a thousand threads could be drawn out and spun as easily as one. This is the invention generally ascribed to Sir

Richard Arkwright, but which others attribute to a John Wyatt, whose partner, a man named Lewis Paul, took out a patent in 1768 for this very machine. Another invention was made in about 1764, by a poor man named Hargreaves; he called it a *spinning jenny*, and it is said that he received the original idea of it from seeing a common one-thread spinning-wheel overturned upon the floor, when both the wheel and spindle continued to revolve; this suggested to him the notion of making a frame in which a number of upright spindles should revolve side by side, and all be turned by the motion of the wheel. At first only eight spindles were attached to a frame, but more were added and many other improvements made. These two machines were used to spin all the cotton yarn up to the year 1779, when another improved machine, called the mule-jenny, was invented by Mr. Samuel Crompton, who was himself a weaver, and worked his new machine with his own hands in an attic. The great feature of this new invention was, that it stretched the yarn very gently and steadily after it was twisted, and this produced a much stronger and finer material than any that had been made before. Until the use of this machine it was thought impossible to spin more than eighty hanks of thread, each measuring eight hundred and forty yards, from one pound of cotton, whereas *with it* three hundred and fifty hanks of the same length have been spun from the same weight.

The seed of the cotton is planted in March, April and May; and the cotton is gathered by hand a day or two after the pods burst, which is in August, September or October. It is carefully planted in rows five feet apart, and with a foot and a half between each plant; it is well weeded, thinned, and pruned. In India the cultivation is much more careless, and the quality of the cotton is consequently very inferior. A field of cotton ready for gathering is very beautiful, when the globes of snowy or cream-colored wool are relieved against the dark glossy leaves; and in the hottest climates this effect is still further heightened by the beautiful yellow or purple flowers being still out on many plants, while others bear the ripe cotton.

It is stated that all the countries in the world could never have prepared for use the quantities of cotton now consumed had it not been for the invention of the cotton-gin, by Mr. Eli Whitney, of Connecticut. Cotton that required a hand a day to clean a pound, by this machine could be prepared better for market at the rate of three hundred pounds per day. The cotton is seized by rows of teeth formed of strong wires projecting from a roller, or by teeth like those of a saw, made upon circular plates of iron. These pass between grate bars, set so closely together that the seed cannot pass through, but the cotton is drawn in, and afterward swept off by a cylindrical brush. The importance of this invention cannot be overrated. It gave an impetus to the cultivation of cotton, and consequently its consumption, that revolutionized the industrial interests of the country.

There is both a tree and shrub cotton; the former grows in India, China and Egypt, and some other parts of Africa. The cotton shrub is more cultivated than the tree, and more closely resembles the herbaceous kind. The best cotton grows on the sandy shores and small low islands along the sea coast of South Carolina and Georgia. The cotton plant likes a dry sandy soil, with a great admixture of salt, and if the plants be within the influence of the salt sea spray, the fibres of the cotton will be longer and finer in consequence. This best kind of cotton, which is commonly called *Sea-Island Cotton*, is much longer in its fibre than any other; it is strong and even silky in texture, and has a yellowish hue. It is believed that Persia is the native country of this species of cotton.

Flax.—The most common variety of the flax plant has a very slender erect stem, two or three feet high, branching only near the top, so as to form a loose corymb of flowers. The leaves are small, distant, and lanceolate; the flowers of a beautiful blue, rarely white, rather broader than a sixpence; the petals slightly notched along the margin; the sepals ovate, three-nerved, ciliated, destitute of glands; the capsules scarcely longer than the calyx, not bursting open elastically, but firmly retaining their seeds, which



FLAX.

are dark brown, glossy, oval-oblong, flattened, with acute edges, pointed at one end, and about a line in length. This plant is highly valuable both for the fibres of its inner bark and for its seeds. The fibres of the inner bark, when separated both from the bark and from the inner woody portion of the stem, are flax or lint, the well-known material of which linen thread and cloth are made, and used equally for the finest and coarsest fabrics, for the most delicate cambric or exquisite lace, and for the strongest sail-cloth. The seeds yield by expression the fixed oil called linseed oil, so much used for mixing paints, making varnishes, etc.; whilst the remaining crushed mass is the linseed cake, or oil cake, greatly esteemed for feeding cattle, and when ground to a fine powder, becomes the linseed meal so useful for poultices.

When the seeds are beginning to change from a green to a pale brown, is the best time for pulling flax. Where the crop grows of different lengths, these lengths should be pulled and kept separately, uniformity in this respect being of great value in the after-processes. The process first gone through after pulling is *rippling*—which consists in tearing off the bolls by pulling the stalks through a series of iron teeth eighteen inches long, placed within a distance of half an inch of each other. These are fastened in a block of wood, which is placed at the end of a plank or long stool on which the operator sits. The next process is to obtain the flaxen fibre or lint free from the woody core, or *boon*, of the stem. This is effected by steeping the bundles in water till the boon begins

to rot, in which state it is readily separated from the fibre. The operation is called *rotting* or *retting*, and requires to be managed with great care, as by continuing it too long, decomposition might extend to the fibre, and render it useless; while by discontinuing it too soon, the separation could not be effected with sufficient ease. The time is generally determined by the nature and temperature of the water and the ripeness of the flax. After being sufficiently steeped, the flax is spread out on the grass, to rectify any defect in the retting, and ultimately to dry it for the breaking. It is now

ready to be freed completely of its woody particles. This is effected by *scutching*. Previous to this, however, the flax is passed through a brake or revolving rollers, in order thoroughly to crack the boon. The brake, worked by manual labor, consists of a frame, in the upper side of which are a number of grooves; a movable piece is hinged at one end, and provided with a similar grooved piece on its lower side, but so placed that the projections pass into the hollows of the lower. The flax, placed between these, and struck by bringing down the hinged part, is broken, but the fibre remains uninjured.

Hemp.—Like flax, hemp adapts itself to diversities of climate, and is cultivated equally under the burning sun of the tropics, and in the northern parts of Russia. It is, however, readily injured by frost, particularly when young; and in many countries where it is cultivated, it succeeds only because their summer is sufficient for its whole life. It varies very much in height, according to the soil and climate, being sometimes only three or four feet, and sometimes fifteen or twenty feet, or even more. The flowers are yellowish green, small and numerous; the male flowers in axillary racemes on the upper parts of the plant; the female flowers in short axillary, and rather crowded spikes. The female plants



HEMP.

are higher and stronger than the male. The stem of hemp is hollow or only filled with a soft pith. This pith is surrounded by a tender, brittle substance, consisting chiefly of cellular tissue, with some woody fibre, which is called the *reed*, *boon*, or *shove* of hemp. Over this is the thin bark, composed chiefly of fibres extending in a parallel direction along the stalk, with an outer membrane or cuticle.

Hemp is cultivated for its fibre in almost all countries of Europe, and in many other temperate parts of the world; most extensively in Poland, and in the center and south of European Russia, which are the chief hemp-ex-

porting countries. The finer kinds are used for making cloth; the coarser, for sail-cloth and ropes. Hemp sown thin produces a coarser fibre than that which is sown thick. Something also depends upon the time of pulling, for the crop is pulled by hand. When a rather fine fibre is wanted, and the seed is not regarded, the whole crop is pulled at once, soon after flowering; otherwise, it is usual to pull the male plants as soon as they have shed their pollen, and to leave the female plants to ripen their seed, in which case the fibre of the female plants is much coarser. The treatment of hemp, by *retting*, etc., is similar to that of flax.

Sugar.—This well-known article may be made from various products, but the ordinary sugar of commerce is that made from the juice of the sugar cane, a native of tropical and sub-tropical countries. It is usually propagated by cuttings. For this purpose the top joints are used. The cuttings are planted in rows three or four feet apart, and at intervals of about two feet in the rows. The largest varieties, in rich moist soils, attain a height of twenty feet; but in dry, poor soil, the height is sometimes scarcely more than six feet. The plant *tillers* like wheat, but not to the same degree. The cane ground is kept clean by hand-hoeing, or by the plough. Hand-hoeing was formerly universal in the West Indies, but the plough is now very generally used where the nature of the ground permits. The best varieties are ready for cutting in about ten months from the time of planting, but other varieties require a longer period of growth, from twelve to twenty months. When the canes are fully ripe, they are cut a little above the ground, and tied in bundles to be conveyed to the mill. Fresh canes, called *rattoons*, spring from the root, so that the plantation does not require to be renewed for several years; but the canes of the first crop are the largest, and a gradual decrease of size takes place. The ordinary practice on sugar estates is to renew a part of the plantation every year.

The extraction of juice from the sugar-cane is effected by simple pressure. The canes, freed from all loose leaves, are passed between the rollers of the machine, under great pressure. From one hundred pounds of cane sixty-five to seventy-five pounds of cane juice will be expressed. This juice, which has a sweetish taste and is of the color of dirty water, passes direct from the mill to a small reservoir, where it usually receives a small dose of quicklime, and without delay runs off to large iron or copper vessels, heated either by a fire underneath, or by steam-pipes in the liquid. As the temperature of the juice rises, a thick scum comes to the top, which is either removed by skimming, or the warm juice is drawn off from below the scum. The concentration of the juice is partly effected in a series of large open hemispherical iron pans about six to eight feet in diameter, of which five or six are placed in a row, with a large fire under the one at the end. This one fire, which runs along under the whole row of pans, is found sufficient to make two or three of them nearest the fire boil violently, and in addition, it warms the juice in the pans farthest from the fire. As the juice first enters the pans farthest from the fire, it gets gradually heated, and the vegetable impurities rise in scum to the top, and are carefully removed. As the juice is ladled from one pan to the next, it boils with greater and greater vigor as it approaches nearer the fire, until in the pan immediately over the fire it seethes and foams with excessive violence; and this seems to be essential to the successful making of sugar. After the concentration has been carried to a given point, and all the scum has been got rid of, the application of a high heat, which would act with an increasingly destructive

effect as the condensation becomes greater, is suspended, and the liquor, now of the color of turbid port wine, and of the consistency of oil, is drawn into the vacuum-pan, where the concentration is completed at the lowest possible temperature, generally about 150° Fahrenheit. The vacuum-pan



GATHERING SUGAR-CANE.

is generally made of copper, of a spherical form, and from six to nine feet in diameter. The bottom is double, leaving a space of an inch or two for the admission of steam between the two bottoms, and there is generally a long coiled copper pipe of three or four inches diameter above the inner bottom, so as to still further increase the amount of heating surface. This apparatus is made perfectly air tight and steam tight. Leading from its upper

dome there is a large pipe communicating with a condenser, into which a rush of cold water is continually passing, so as to condense all the steam or vapor that arises from the liquid boiling in the vacuum-pan. The water which is constantly rushing into the condenser is as steadily withdrawn again by the pump. There is thus a constant vacuum in the pan, and, consequently the liquid in it will boil at a much lower temperature than it would in an open pan or boiler.

As the concentration of the liquid in the vacuum pan proceeds, crystals of sugar begin to form, and the skill of the sugar boiler is shown by the uniformity of the crystals he produces. The boiling is commenced by filling in only a third or fourth of the quantity the vacuum pan will hold, and gradually adding more liquid as the crystals increase in size. The sugar boiler is able to watch the changes going on in the vacuum-pan by means of small samples he withdraws from it by means of a suitable apparatus. The sugar-boiler holds those drops of thick fluid on his finger and thumb, between his eye and a strong light, and is thus able to detect those minute changes in its condition which show that it is time to add an additional quantity. By the time the vacuum-pan is full, the contents have thickened, by the formation of crystals of sugar, into a mass of the consistency of thick gruel; it is then allowed to descend into a vessel called the heater, where it is simply kept warm until it can be run out into the "forms," which, in the sugar-growing colonies, are generally conical earthen pots, holding from one to two cwts. of sugar. It is allowed to cool and complete its crystallization before the plugs, which close the bottom of the pots, are withdrawn. When this is done, from one-fourth to one-third of the contents of the form, which has remained in a fluid state, runs off into gutters leading to large tanks, from which it is again pumped up into the vacuum-pan, and reboiled, yielding a second quality of sugar. This reboiling of the drainings is repeated, with a continually decreasing result, both as to quantity and quality of the solid sugar obtained, and it is rarely carried beyond the fourth boiling. If the planter wishes to obtain Muscovada or unclayed sugar, the process is now complete, and the sugar is turned out of the forms, and packed for shipment. In some cases, the sugar is run direct from the vacuum pans into casks or hogshead, which replace the forms, holes being bored in the bottoms of the casks, to admit of the uncrystallized portion of the sugar draining out.

If *clayed* sugar is to be made, the forms are allowed to stand for a few days until all the molasses has drained out; and a quantity of thin mud, about the consistency of good thick cream, is then poured over the sugar, to the depth of one or two inches. The water contained in this thin mud slowly steals down through the sugar, and mixing with the coatings of molasses still adhering to the outsides of the crystals of sugar, renders them less viscid, and facilitates their descent to the bottom of the form. The mud remains, at the end of a few days, in the form of a dry hard cake on the top of the sugar, and none mixes with the sugar. The process of claying sugar is simply washing off a coating of black and yellow molasses from a crystal of sugar, which is always white. This operation is possible without dissolving the crystal of sugar, simply because the molasses has a greater affinity for water than the crystallized sugar has. Into the various processes of sugar refining we have not space to enter.

Tobacco.—Tobacco is a herbaceous plant, with large broad leaves, and everywhere covered with clammy hairs. It is a native of the warm parts of

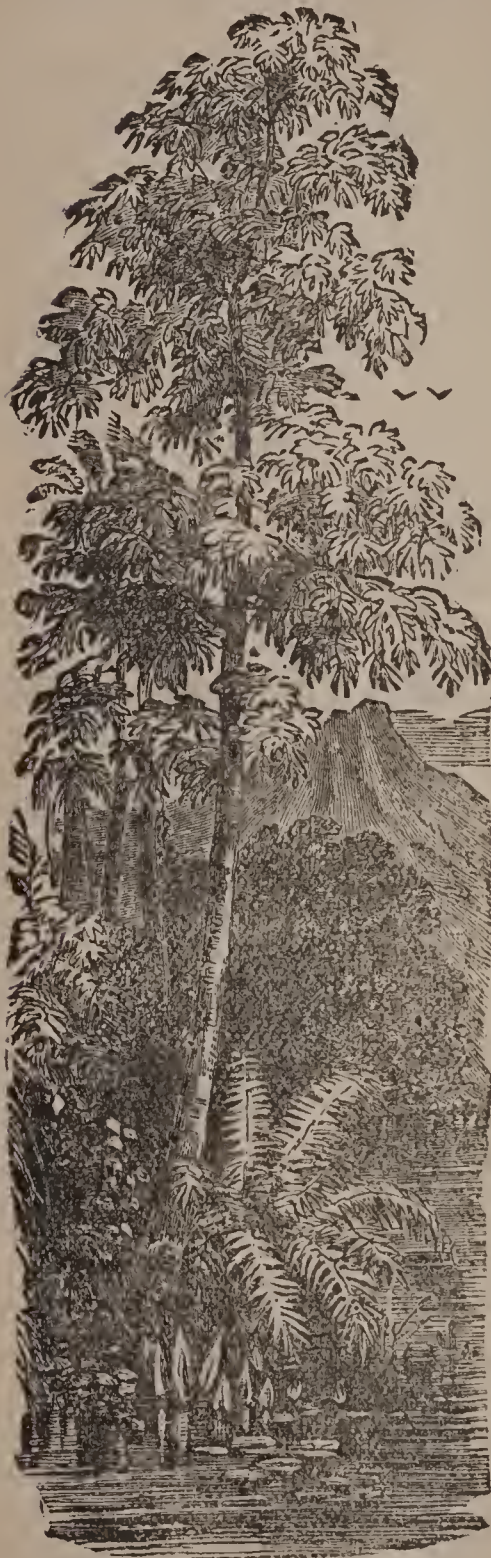
the United States and other tropical countries. It is cultivated on account of its narcotic property, which resides in all parts of the plant, though the leaves are almost exclusively used. The Virginian tobacco attains at maturity a height of five or six feet, has leaves from six to eighteen inches long, and rose-colored flowers. The cultivation of tobacco is not difficult, and, although a warm climate suits it best, it is successfully raised in comparatively cold latitudes. The usual plan in the great tobacco producing countries is to sow the seed in seed-beds of rich soil, and as the seed is extremely minute, it is first mixed largely with sand or wood ashes, to assist in spreading it thinly. In Virginia, which may be taken as one of the best tobacco-growing districts, this is usually done in the first week in January. After the seed-beds have been carefully prepared and sown, small branches of trees are laid over, to protect the seed when it germinates from the effects of frost; but these are removed as soon as can be done with safety, and the plants then grow rapidly, and are ready for transplanting into the fields about the beginning of June. The land in the fields is very carefully prepared, and small hillocks are raised up in rows; each is about a foot in diameter, and flattened at the top. With the first appearance of rain, the plants are carefully raised from the seed-beds, and carried, usually by children, who deposit one on each hillock, on which it is carefully planted by experienced men, who follow after the children. Only wet weather will do for planting, so that this operation often lasts until the end of July. When planted, the tobacco crop requires much careful attention to weeding, and a watchful eye to prevent the ravages of various insect enemies. Much of this latter work is done by flocks of turkeys, kept on purpose by the planters. As soon as the plants begin to throw up the flower shoot, it is nipped off; otherwise it would weaken the leaves; but this process is neglected in some countries, especially in Turkey and Greece, where small leaves are preferred, and where, in some cases, as in the celebrated Latakia tobacco, both leaves, buds, and flowers are used. The time generally chosen for cutting it is mid-day, or when the sun is powerful, and the morning and evening dews absent. The cutting is done by hand, and only such plants are chosen as are ready, which is known by a clammy exudation which forms over the leaf, often giving it a spotted appearance. If the plants are very large, the stalk is often split down, to facilitate the drying. They are then removed from the field to the tobacco house, around which are erected light scaffolds, to which the plants are suspended, generally by passing a thin stick through a split in the stalk of each, and so placing a number of plants on each stick, just near enough to prevent them touching each other. After some time hanging in the open air, the plants on the sticks are removed, and suspended in a similar way inside the curing house, until the drying is completed. The leaves are removed from the stalks, and all bad ones rejected. The chosen ones are tied up in bundles called hands; these are solidly packed in hogs-



TOBACCO.

heads, and in this condition are transported to market. The consumption in nearly all parts of the world is very great.

The India Rubber Tree.—The India rubber tree is found in parts of Mexico, Central and South America, and in the East Indies, and is one of the noblest and most picturesque of all the trees of the forest. In Assam, beyond the Ganges, it is found in inexhaustible abundance. It is either solitary, or in two or three fold groups; is large and umbrageous, and may be distinguished from other trees at a distance of several miles by the striking beauty of its dense and lofty crown. The main trunk of one of the Assam trees measured seventy-four feet in circumference, and the area covered by its expanded branches had a circumference of six hundred and ten feet. The height of the central tree was one hundred feet. It has been estimated that there are over forty-three thousand such trees in one district within an area of thirty miles by eight. It grows on the slopes of the mountains from the valleys up to an elevation of twenty-two thousand feet. The raw seeds are poisonous to man and quadrupeds, but macaws eat them, and they are used as bait for fish. Long boiling deprives them of their poison.



THE INDIA RUBBER TREE.

A large proportion of the quantity of rubber or caoutchouc furnished to commerce comes from Brazil. The tree is tapped in the morning, and during the day a gill of fluid is received in a clay cup placed at each incision in the trunk. This when full is turned into a jar, and is ready at once to be poured over any pattern of clay, the form of which it takes as successive layers are thus applied. It comes from the tree purely colorless, like milk, but when dried by the sun it is white within and a yellowish-brown without. Its drying and hardening are hastened by exposure to the smoke and heat of a fire, and it thus acquires its ordinary black color. Complete drying by the

sun requires several days' exposure; during this time the substance is soft enough to receive impressions from a stick, and is thus ornamented with various designs. The natives collect it upon balls of clay in the forms

of bottles and various fanciful figures, in which shape it is often exported. The clay mold over which the bottles are formed, being broken up, is extracted through the open neck. Usually it has been brought to this country in flat cakes; but a method has been devised by which the liquid is shipped in air-tight vessels of tin or glass just as it comes from the tree.

Gutta Percha.—This substance, in many respects similar to caoutchouc, or India rubber, is the dried milky juice of a tree which is found in the peninsula of Malacca and the Malayan Archipelago. It is a very large tree, the trunk being sometimes three feet in diameter, although it is of little use as a timber tree, the wood being spongy. The leaves are alternate, on long stalks, somewhat leathery, green above and of a golden color beneath. The flowers are in little tufts in the axils of the leaves, small, each on a distinct stalk. The present mode of obtaining the gutta percha is a most destructive one. The finest trees are selected and cut down, and the bark stripped off; between the wood and bark, a milky juice is found, which is scraped up into little troughs made of plantain leaves. This is the gutta percha, which, as it hardens, is kneaded into cakes, and exported. It has a very light reddish-brown, or almost a flesh color, is full of irregular pores elongated in the direction in which the mass has been kneaded. It has a cork-like appearance when cut, and a peculiar cheese-like odor. Before it can be used, it has to undergo some preparation. This consists in slicing the lumps into thin shavings, which are placed in a *devilling* or tearing machine revolving in a trough of hot water. This reduces the shavings to exceedingly small pieces, which by the agitation of the tearing teeth are washed free from many impurities, especially fragments of the bark of the tree, which, if not separated, would interfere with the compactness of its texture, which is one of its most important qualities. The small fragments, when sufficiently cleansed, are kneaded into masses which are rolled several times between heated cylinders, which press out any air or water and render the mass uniform in texture. It is then rolled between heated steel rollers into sheets of various thickness for use, or is formed into rods, pipes for water, or speaking-tubes, and an endless number of other articles. Gutta percha differs very materially from caoutchouc or India rubber in being non-elastic, or elastic only in a very small degree.



GUTTA PERCHA.

The Cork Tree.—The cork tree is a species of oak which grows abundantly in Spain, Portugal, Italy and the northern part of Africa. It grows to a height of from twenty to forty feet, and has long evergreen leaves. The bark in trees or branches from three to five years old acquires a fungus appearance, new layers of cellular tissue being formed, and the outer parts cracking from distension, until they are finally thrown off in large flakes, when a new formation of the same kind takes place. Cork intended for the market is generally stripped off a year or two before it would naturally come away, and the process is repeated at intervals of six or eight years. The bark of young trees and branches is either useless or of very inferior quality; it is only after the third peeling that good cork is produced. The removal of the cork being not the removal of the whole bark, but only of external layers of spongy cellular tissue, all or greater part of which has ceased to have any true vitality, and has become an incumbrance to the tree, is so far from being injurious, that when done with proper care, it rather promotes the health of the tree, which continues to yield crops of cork for almost one hundred and fifty years. In stripping off the cork, longitudinal and transverse incisions are made to the proper depth, and each piece is then cut away from the tree by a curved knife with two handles. The pieces are soaked in water, pressed flat, dried and superficially charred, to remove decayed parts and conceal blemishes, before they are packed in bales for the market.

The Castor Oil Plant.—The castor oil plant belongs to an order whose affinities have not yet been accurately limited by botanists; but it is supposed to comprise at least one thousand five hundred species, distributed in each quarter of the globe from the equator to latitudes as high as Great Britain; sometimes in the form of large trees, frequently of bushes, still more usually of diminutive weeds, and occasionally of deformed, leafless, succulent plants, resembling the cacti. The plant is highly valuable for the excellent medical virtues of the oil which it furnishes; its root is said to be diuretic. The positions of the flowers are shown in our illustration; but it is from the seed that the oil is extracted, three of which, of an oblong flattish form, are enclosed in each receptacle. The oil is prepared chiefly in the East Indies and in the West India Islands, the United States, and also in the south of Europe. In extracting the oil, the seeds are first bruised between heavy rollers, and then pressed in hempen bags under a hydraulic or screw press. The best variety of oil is thus obtained by pressure in the cold, and is known as *cold-drawn* castor oil; but if the bruised and pressed seeds be afterwards steamed, or heated, and again pressed, a second quality of oil is obtained, which is apt to become partially solid or frozen in cold weather. In either case the crude oil is heated with water to 212°, which coagulates, and separates the albumen and other impurities. Exposure to the sun's light bleaches the oil, and this process is resorted to on the large scale. When pure and cold drawn, castor oil is of a light-yellow color; but when of inferior quality, it has a greenish, and occasionally a brownish tinge.

The Camphor Tree.—The *Laurus camphora* of China is an evergreen of the laurel family, having glossy leaves and bearing clusters of yellowish flowers, which are succeeded by bunches of fruit resembling black currants. This valuable tree, which often adorns the banks of the rivers, was in several places found by Lord Amherst's embassy above fifty feet high, with the



THE CASTOR OIL PLANT.

trunk twenty feet in circumference. The Chinese themselves affirm that it sometimes attains the height of more than three hundred feet, and a circum-

ference greater than the extended arms of twenty men could embrace. Camphor is obtained from the branches by steeping them, while fresh cut, in water for two or three days, and then boiling them till the gum, in the form of a white jelly, adheres to a stick which is used in constantly stirring the branches. The fluid is then poured into a glazed vessel, where it concretes in a few hours. To purify it the Chinese take a quantity of finely-powdered earth, which they lay at the bottom of a copper basin; over this they place a layer of camphor, and then another layer of earth, and so on until the vessel is nearly filled, the last or topmost layer being of earth. They cover this last layer with leaves of a plant called poho, which seems to be a species of *mentha* (mint). They now invert a second basin over the



THE CAMPHOR TREE.

first, and make it air-tight by luting. The whole is then submitted to the action of a regulated fire for a certain time, and then left to cool gradually. On separating the vessels the camphor is found to have sublimed, and to have adhered to the upper basin. Repetitions of the same process complete its refinement. Besides yielding this invaluable ingredient, the camphor tree is one of the principal timber trees of China, and is used not only in building but in most articles of furniture. The wood is dry and of a light color.

In the Island of Sumatra there is a variety of the camphor-tree which is much larger than that of China, under the bark of which the gum is found in a concrete form, and from which it is brushed down carefully with long

brooms. Another variety of the same tree yields its gum in the form of pith. In this case the gatherers first pierce the trees with an axe to discover their worth, as no outward sign betrays whether the heart of the tree will be found to contain oil, a resinous pitch, or gum. After the axe has disclosed the white and shining substance for which they seek, the tree is cut down, divided into lengths of about three feet, and split open very carefully, when the gum is taken out in solid rolls, often as large as a man's arm, and all ready for market. One tree sometimes furnishes as much as eleven pounds of gum, of so fine a quality as to be valued by the Chinese at fifty times the price of that produced by their own trees. This superior quality, of which the Island of Sumatra yields only about three hundred pounds a year, is rarely, if ever, exported.

Peppermint.—The mint family of plants, of which the most important species are peppermint, spearmint and penny-royal, all contain an aromatic essential oil, possessing medicinal qualities. The peppermint plant is widely distributed over the temperate parts of the world, is easily propagated and readily recognized by the peculiar pungency of its odor. Wayne County,



PEPPERMINT.

New York, produces about two-thirds of the peppermint crop of the United States. It is grown on black ash swamps, which have been under-drained thoroughly, from roots which are planted as hops are. When cut it is partially dried and taken to a still, where the oil is extracted. The oil sells from \$2.50 to \$5 per pound, and when it brings \$3 the crop is a paying one,

About seventy thousand pounds are used annually in producing medicines, manufacturing candies, and making cordials.

Wine Growing.—In Spain, Portugal, France, Italy and elsewhere the manufacture of wine from grapes is an important industry of the people. It is said that in the south of France, wine is drank almost as freely as water in other countries. The peasant women of these localities labor almost exclusively out of doors, and may be seen, not only engaged in gathering the grapes, but in carrying huge baskets of them to the wine-presses.

Attar of Roses.—The rose gardens of Ghazepore are fields in which all rose-bushes are planted in rows. In the morning they are red with



WINE GROWING.

blossoms, but these are all gathered before mid-day, and their leaves distilled in clay stills, with twice their weight of water. The water which comes over is placed in open vessels, covered with a moist muslin cloth, to keep out dust and flies, and exposed all night to the cool air, or to artificial cold—as we set out milk to throw out its cream. In the morning, a thin film of oil has collected on the top, which is swept off with a feather, and carefully transferred to a small phial. This is repeated night after night, till nearly the whole of the oil is separated from the water. Twenty thousand roses are required to yield a rupee-weight of oil, which sells for \$50. Pure attar of roses is, therefore, seldom to be met with. That which is so

in the Indian bazars is adulterated with sandal-wood oil, or diluted with sweet salad oils. What we obtain in America is generally still more diluted, as the price we usually give for it sufficiently shows.

Apricots.—The apricot is a species of the same genus as the plum, and is a native of Armenia, and of the countries eastward to China and Japan; a middle-sized tree of fifteen to twenty or even thirty feet high, with smooth, doubly-toothed leaves on long stalks, white flowers which appear before the leaves, and fruit resembling the peach, roundish, downy, yellow, and ruddy on the side next the sun, with yellow flesh. More than twenty kinds are distinguished, amongst which some excel very much in size, fine color, sweetness, and abundance of juice. The apricot is generally budded on plum or wild cherry stocks. The fruit keeps only for a very short time, and is either eaten fresh, or made into a preserve or jelly. Apricots split up, having the stone taken out, and dried, are brought from Italy as an article of commerce; in the south of France, also, they are an article of export in a preserved and candied state. Dried apricots from Bokhara, the kernels of which are perfectly sweet, are sold in the towns of Russia.

Rice.—Rice is cultivated extensively in the Southern States of America, China, India, Japan, and elsewhere. The grains of this plant grow on separate pedicles, or little fruit-stalks, springing from the main stalk. The whole head forms what a botanist would call a spiked panicle; that is, something between a spike like wheat, and a panicle like oats. The grain is sown in rows, in the bottom of trenches. These ridges lie about seventeen inches apart, from center to center. The rice is put in by the hand, and is never scattered, but cast so as to fall in a line. This is done about the 17th of March. By means of flood-gates, the water is then permitted to flow over the fields, and to remain on the ground five days, at the depth of several inches. The object of this drenching is to sprout the seeds, as it is technically called. The water is next drawn off, and the ground allowed to dry, until the rice is risen to what is termed four leaves high, or between three and four inches. This requires about a month. The fields are then again overflowed, and they remain submerged for upwards of a fortnight, to destroy the grass and weeds. These processes occupy till about the 17th of May, after which the ground is allowed to remain dry till the 15th of July, during which interval it is repeatedly hoed, to remove such weeds as have not been effectually drowned, and also to loosen the soil. The water is then, for the last time, introduced, in order that the rice may be brought to maturity; and it actually ripens while standing in the water. The harvest commences about the end of August, and extends into October. After being cut the rice is bound up into bundles, and afterward threshed with a flail. The next process is to detach the outer husk, which clings to the grain with great pertinacity. This is done by passing the rice between a pair of millstones, removed to a considerable distance from each other. The inner pellicle, or film, which envelopes the grain, is removed by trituration in mortars under pestles weighing from two hundred and fifty to three hundred pounds. The pestles consist of upright bars, shod with iron, which being raised up by the machinery to the height of several feet, are allowed to fall upon the rice, the particles of which are thus rubbed against one another until the film is removed. It is now thoroughly winnowed, and, being packed in casks holding about six hundred pounds each, is ready for market.

The Tapioca Plant.—The tapioca plant is a native of Central and South America, and much cultivated there. It is now also largely grown in Western Africa, where it is called cassava. The plant grows in a bushy form, with stems usually from six to eight feet high. The roots are very large, from three to eight growing in a cluster, usually from a foot to two feet long. The starch in the roots is separated from the fibre, and from this

starch the tapioca of commerce is made by heating it on hot plates and stirring with an iron rod; the starch grains burst, and the whole forms into small, irregular masses, such as we find in the stores.



THE NUTMEG.

Nutmegs.—The spice known in commerce under this name is the kernel of the seed of *Myristica fragrans*, a diœcious evergreen tree about fifty or sixty feet high, found wild in the Banda Islands and the neighboring country extending to New Guinea, but not to The Philippines. The leaves resemble the laurel; the flowers are white, two or three on a peduncle. The nutmeg proceeds from a reddish knob in the center of the flower, yet not more than one-third ripen. The fruit is the size of an apricot, pear-shaped. When ripe it opens and displays the nutmeg in a black and shining shell, inclosed in a network of scarlet mace.

The shell is like that of a filbert; it is dried with care, and when the nutmeg shakes in it is broken, and the nutmeg soaked in sea-water and lime to preserve it from insects. The trees yield fruit in eight years after sowing the seed, reach their prime in twenty-five years and bear for sixty years or longer. The tree bears all the year round, but the chief harvest takes place in the later months of the year, and a smaller one in April, May, and June.

Ginger.—This is the root, or rather the underground stem, of a plant which is a native of the East Indies; but is now grown in many other trop-

ical countries. The stem grows two or three feet high, and is reed like; the flowers are borne on a separate stalk, of a dark purple color, and appear from between broad scales. Our supply comes from both the East and



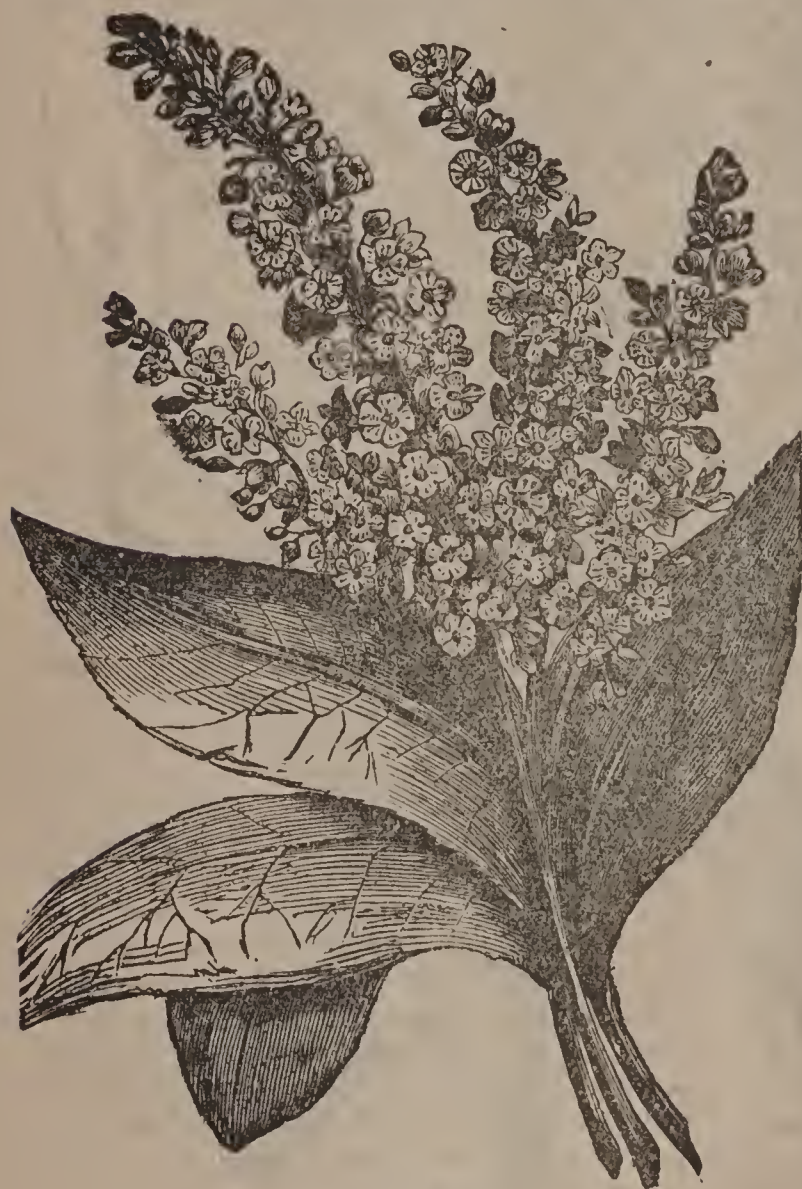
THE CLOVE TREE.

West Indies; and is imported in the root, which differs much in appearance and quality.

Cloves.—Cloves are the unopened flowers of a small evergreen tree that resembles in appearance the laurel or the bay. It is a native of the Molucca or Spice Islands, but has been carried to all the warmer parts of the world, and it is now cultivated in the tropical regions of America. The flowers are small in size, and grow in large numbers, in clusters, to the very end of the branches. The cloves we use are the flowers gathered before they are

opened, and while they are still green. After being gathered they are smoked by a wood fire, and then dried in the sun. Each clove consists of two parts—of a round head, which is the four petals, or leaves, or flowers rolled up, inclosing a number of small stalks or filaments; the other part of the clove is terminated with four points, and is, in fact, the flower-cup of the unripe seed-vessel. All these parts may be distinctly seen if a few cloves are soaked for a short time in hot water, when the leaves of the flower

soften, and readily unroll. Both the taste and the smell of cloves depend on the quantity of oil they contain. Sometimes the oil is separated from the cloves before they are sold, and the odor and taste are, in consequence, much weakened.



CINNAMON.

Cinnamon.—

Cinnamon is the bark of a small tree, the *Cinnamomum Zeylanicum*, which, as its name imports, is a native of Ceylon, and chiefly cultivated there, though it is raised also in Java. The tree is very graceful; the leaves, which are red in spring, become thick, leathery, and glossy-green as the summer advances; they are netted with raised veins on the under side, and are placed opposite each other on the stem;

the flowers are greenish-white, and grow in small, loose clusters at the termination of the branches. The trees require a rich, light soil, and also shade; they are, therefore, planted in open glades of the forest, where a few large timber trees remain to shelter them; this greatly contributes to the beauty of the cinnamon harvest, when the natives assemble to strip the bark, their graceful figures and bright-colored clothing forming picturesque groups in the forest glades, and the whole air being loaded with the scent of the spice. Cinnamon peeling begins in May, at the end of the rains, and lasts till November. The peeling simply consists in slitting the bark and cutting it across, so as to turn it back; it is then soaked to remove the outer

rind, and rolled up into quills about three feet long, and it is then fit for exportation. Cinnamon contains volatile oil, tannin, a mucilage, vegeto-animal coloring matter, an acid and a woody fibre.

Allspice.—Pimento, or Jamaica pepper, otherwise called allspice, is a small berry, the fruit of a beautiful tree, about thirty feet high, with a straight trunk much branched above and covered with a very smooth, gray bark. Its dense and ever-verdant foliage gives it, at all times, a refreshing appearance. The leaves vary in shape and size, and are usually about four inches long, resembling those of the bay, and are of a dark, shining green. The tree exhales an aromatic fragrance, especially during the months of August and September, when the trees are in full bloom, the blossoms consisting of small, white flowers, which form a most delightful contrast with the dark green leaves. The rich per-

fume which is exhaled and wafted by the gentlest breeze makes a plantation of the trees one of the

most delightful spots imaginable. The berries, as they reach us, are of different sizes, usually about as large as a small pea, of a brownish color, and when broken present two cells, each containing a black seed. They have a fragrant odor, thought to resemble that of a mixture of cinnamon, cloves and nutmegs; hence the name allspice, by which they are best known in this country. Pimento is a native of the West Indies and South America, and is abundant in Jamaica, whence it received its name, Jamaica pepper. The berries are gathered after having attained their full size, but while yet green, and are carefully dried in the sun and put in bags and casks for exportation.

Pepper.—Pepper is the fruit of a climbing or creeping plant called *Piper nigrum*, which has alternate leaves, jointed stems, and spikes of naked flowers; the berry is small, round, and fleshy. This plant grows abundantly in Sumatra, Java, Borneo, and the Malay Peninsula. The pepper vines, as they are called, are trained to trees and



THE ALMOND.



ALLSPICE.

shrubs, and are allowed to grow four years without gathering the crop; this takes place while the berries are still green, before they are ripe, and they are dried quickly on mats in the sun, which turns them black, therefore it

is called black pepper; white pepper is produced by soaking the berries till the outer skin peels off readily. Long pepper is the fruit of the *Piper longum*, also a native of the East Indies; in long pepper the spike and half-ripe berries are all dried together, which makes it resemble the catkins of the birch; the flavor is like that of black pepper. Cayenne pepper is the dried and ground fruit of the *Capsicum*, a genus of plants related to the woody



THE COCOANUT TREE.

nightshade; these fruits are fleshy, and bright scarlet or orange, very pungent, and much used in flavoring, both in their unprepared state and ground.

Almonds.—Almonds come from Spain and Italy, but they grow spontaneously in many other warm countries. The almond-tree, *Amygdalus communis*, greatly resembles the peach in growth, leaves and blossoms; it flowers in the early spring, and produces fruit in August. The fruit is covered with a tough skin, and is enclosed in a rough shell. There are two kinds of almonds, the sweet and the bitter, only differing from each other in the flavor of the nut. Valencia almonds are sweet and large; Italian not

either so large or sweet. Jordan almonds come from Malaga; they are long, and not very pointed, and are the best kind imported; the bitter almonds come chiefly from Mogadore, on the northern coast of Africa.

Cocoanuts.—Cocoanuts are the fruit of the *Cocos nucifera*, or cocoanut palm, a lofty and elegant palm-tree which grows abundantly in most tropical countries; it is from fifty to sixty feet in height, its simple column-like stem being crowned with a beautiful plume of feathery leaves from twelve to fourteen feet long. The nuts grow in several long clusters depending from the base of the leaves; they are about the size of a man's head, the



THE PINEAPPLE.

thin outer rind covering a large mass of fibres, which are used in many countries for the making of mats, cordage, and coarse sail-cloth. Within this fibrous coating is the shell of the nut, which is oval and very hard, and often serves for a drinking cup. The kernel is firm, white, and pleasant; the interior hollow, and filled with sweet milky juice; when unripe, it is entirely filled with this juice. The cocoanut palm abounds in the East Indies, throughout the tropical islands of the Pacific, and also in the West Indies and South America. On the Malabar and Coromandel coasts of India immense groves may be seen. In Ceylon, which is peculiarly well suited for their cultivation, it is estimated that twenty millions of these trees are growing. Here it stands at the head of all trees in its usefulness to man, every particle of stem, leaves and fruit being put to use, and the Cingalese love to repeat to strangers the hundred uses to which they apply it. The

following are only a few of the countless uses of this invaluable tree: The *leaves*, for roofing, for mats, for baskets, torches or chules, fuel, brooms, fodder for cattle, manure. The *stem of the leaf*, for fences, for pingoes (or yokes) for carrying burdens on the shoulders, for fishing-rods, and innumerable domestic utensils. The *cabbage*, or cluster of unexpanded leaves, for pickles and preserves. The *sap*, for toddy, for distilling arrack, and for making vinegar and sugar. The *unformed nut*, for medicine and sweet-meats. The *young nut* and its milk, for drinking for dessert; the *green husk*, for preserves. The *nut*, for eating, for curry, for milk, for cooking. The *oil*, for rheumatism, for anointing the hair, for soap, for candles, for light; and the *poonak*, or refuse of the nut, after expressing the oil, for cattle and

poultry. The *shell of the nut*, for drinking-cups, charcoal, tooth-powder, spoons, medicine, hook-ahs, beads, bottles and knife-handles. The *coir*, or fibre which envelopes the shell within the outer husk, for mattresses, cushions, ropes, cables, cordage, canvas, fishing-nets, fuel, brushes, oakum, and floor-mats. The *trunk*, for rafters, laths, railing, boats, troughs, furniture, fire-wood; and when very young, the first shoots, or cabbage, as a vegetable for the table.



THE BANANA TREE.

deners for planting. The pineapple is a native of tropical America; it is found wild in sandy maritime districts in the northeast of South America, but it has been very much changed by cultivation. It has also been gradually diffused over tropical and subtropical countries, and not only as a cultivated plant, for it is fully naturalized in many parts both of Asia and Africa. It delights in a moist climate.

Bananas.—This much-prized tropical fruit comes chiefly from Central America and the West Indies. There are many varieties, some of which grow upon large trees, but the majority are of the dwarf species, which are propagated from cuttings and renewed every year. Nine months after a cutting has been planted a purple bud appears in the center of the unfolding leaves that shoot out from the head of the parent stem. The stem on which the bud appears grows rapidly above the main stalk. As the bud in-

Pineapples.—The pineapple has a number of long, serrated, sharp-pointed, rigid leaves, springing from the root, in the midst of which a short flower-stem is thrown up, bearing a single spike of flowers, and therefore a single fruit. From the summit of the fruit springs a crown or tuft of small leaves, capable of becoming a new plant, and very generally used by gar-

creases in weight the stem bends downward by a graceful curve, on the extremity of which this bud continues to grow till, the purple blossoms falling off, little shoots appear as the embryo fruit. Each fruit has a yellow blossom at its outward extremity. At the end of from three to four months the fruit has grown to maturity, and is picked long enough before it is "dead ripe" to preserve it in marketable condition. From the roots of the parent stalk other shoots appear, which are trimmed out or left to grow, as the cultivator may deem best. A single stalk, therefore, bears only one bunch or crop as its life work. In regions where no frost ever reaches, bananas are found in all stages of growth, ripening their fruit every month and every day in the year. An estimate by Humboldt claims that forty-four thousand pounds of bananas can be produced on the soil that would be required for one thousand pounds of potatoes, and that the same area that would be required to raise wheat enough for one man, would produce enough bananas to feed twenty-five men.

Dates.—The date is the fruit of a tall and graceful palm, *Phoenix dactylifera*, which shoots up a single straight stem to the height of fifty or sixty feet, and then expands into a beautiful crown of leaves. It is abundant in Barbary, Arabia, Persia, and the adjacent countries, particularly on the confines of the deserts and in the oases. The fruit somewhat resembles a



THE DATE.

plum, but is rather longer in proportion; it contains a long oblong kernel, grooved on one side. The pulp is soft, sweet, and slightly astringent; it is rich in sugar, gum, and other vegetable matter, affording the most wholesome nutriment. Dates form a staple article of food to the inhabitants of many countries where they are grown. The fruit, when gathered quite ripe, is often pressed into large baskets, and thus forms a hard, solid cake, called "adjoue," which is afterward cut up and sold by the pound. Date-stones are soaked in water and given to the cattle.

Raisins.—A strip of land bordering on the Mediterranean, somewhat less than one hundred miles in length, and in width not exceeding five or six, is the raisin producing territory of Spain. Beyond these boundaries the

muscatel grape, from which the raisin is principally produced, may grow and thrive abundantly; but the fruit must go to the market or the wine-press. When the grape begins to ripen in August, the farmer carefully inspects the fruit as it lays on the warm, dry soil, and one by one elips the clusters as they reach perfection. In almost all vineyards slants of masonry are prepared, looking like unglazed hot-beds, and covered with fine pebbles, on which the fruit is exposed to dry. But the small proprietor prefers not to carry his grapes so far; it is better, he thinks, to deposit them nearer at hand, where there is less danger of bruising, and where the bees and wasps are less likely to find them. Day by day the cut bunches are examined and turned, till they are sufficiently cured to be borne to the house, usually on the hill top, and there deposited in the empty wine-press till enough has been collected for the trimmers and packers to begin their work.



THE FIG.

At this stage great piles of rough dried raisins are brought forth from the wine-press and heaped upon boards. One by one the bunches are carefully inspected, those of the first quality being trimmed of all irregularities and imperfect berries, and deposited in piles by themselves. So, in turn, are treated those of the second quality, while the clippings and inferior fruit are received into baskets at the feet of the trimmers, and reserved for home consumption. A quantity of small wooden trays are now brought forward, just the size of a common raisin box and about an inch deep. In these, papers are neatly laid, so as to lap over and cover the raisins evenly deposited in the trays, which are then subjected to a heavy pressure in a rude press. After pressing, the raisins are dropped into the boxes for market.

Figs.—The fig is a low, deciduous tree or shrub, with large deeply-lobed leaves, which are rough above and downy beneath. The branches are clothed with short hairs, and the bark is greenish. The fruit is produced singly in the axils of the leaves, is pear-shaped, and has a very short stalk; the color in some varieties is bluish-black; in others, red, purple, yellow, green, or white. The varieties in cultivation are numerous. In warm climates, the fig yields two crops in the year—one from the older wood (mid-summer shoots of the preceding year); and a second from the young wood (spring shoots of the same year), but in colder regions the latter never comes to perfection. Fig-trees are propagated by seed, by suckers, etc.; very frequently by layers or by cuttings. They are successfully grown in warm climates in nearly all parts of the world. For exportation figs are dried either in the sun or in ovens built for the purpose.

Prunes.—Prunes are made and not grown. Plums are grown, and some sorts of them, when treated in a certain way, become the prunes of

commerce. It is not every plum that can be dried into a prune, as many are inclined to think. Prunes are produced in the various countries of Continental Europe, France, Spain, Germany, and Turkey taking the lead. The plums that are suited for prunes form a distinct group, the most noted variety being the St. Catherine. The plums that are to be made into prunes are left on the trees until they are fully ripe; in fact, until they drop of their own weight. To prevent injury by the fall the ground beneath the trees is either made soft by working it with the plow and harrow, or is covered with straw. The fallen fruit is picked up each day, or every alternate day, washed, if soiled, and then spread out separately on frames of wicker-work, where it is exposed to the rays of the sun. Later on in the drying, the plums are put in ovens similar to the baker's oven, when they are subjected to a heat of about 170 degrees Fahrenheit. At the end of twenty-four hours the fruit is removed from the oven, and when cold is turned upon the trays. The oven is heated again, in the meantime, to about 220 degrees, and the fruit placed in again, when it remains another day. After another cooling and turning the oven is heated to 258 degrees and a third drying given, which usually completes the process. The drying is known to be properly done if there is a certain elasticity to prunes when pressed with the fingers.



THE ORANGE.

The object of all the different parts of the process of drying is to dry the fruit as far as possible without breaking the skin, which, in the well-dried prune, should shine as if it had been given a coat of varnish.



THE LEMON.

Oranges.—The orange-tree grows abundantly in almost all the warm soft climates of southern Europe, northern Africa, and many temperate parts of Asia and America. Those consumed in the Northern States are brought from the islands of the Atlantic and the Southern States. St. Michael, one of the Azores, is famed for producing the most favored variety. The orange gardens are encompassed by high walls, not only to protect the trees from plunderers, but from high winds, which often do serious damage. The orange trees are usually branched almost, if not quite, from the ground; their leaves are evergreen, and their flowers white and very elegant; they yield a delicious

perfume. On many trees the flowers and ripe fruit hang together; and, when thus loaded—the fruit, some of light-green color, others of pale yellow, others of a deep orange, and all set off by the deep glossy-green foliage—the

trees are superb. The fruit is gathered in December, or even earlier, a little while before it is ripe; and large baskets being filled by boys who take them from the gatherers, they are carried away at once to the packers, who most commonly sit in groups on the grass; the oranges are poured out in a heap with as little concern as if they were coals; each orange is wrapped in a husk of Indian corn; these are prepared by children, who hand them to a man, who wraps up the orange and passes it to another, who places it in the chest; this is all done with amazing rapidity. The box is filled, thin

boards are bent over it by a carpenter, and secured with willow bands, and then it is ready to be carried to the port and shipped.



OLIVES.

Lemons.—The lemon is a tree which has by many botanists been regarded as a variety of the citron, and, like it, a native of the north of India. Its leaves are ovate or oblong, usually serrate, pale green, with winged stalk; the flowers are streaked and reddish on the outside; the fruit is oblong, wrinkled or furrowed, pale yellow, with generally concave oil-cysts in the rind. In the common variety, which is very extensively cultivated in many tropical and subtropical countries, the pulp of the fruit is very acid, abounding in citric acid. There is,

however, a variety called the sweet lemon occasionally cultivated in the South of Europe, of which the juice is sweet.

The Olive Tree.—The olive tree, *Olea Europa*, grows abundantly in all the countries bordering on the Mediterranean Sea. It thrives upon the most rocky calcareous soils, seldom exceeds twenty feet in height, but is much branched and spreading; it lives to a great age, and increases very much in bulk, so that one tree may easily, at a little distance, be mistaken for a group. There is an olive tree at Pescio seven hundred years old, and twenty-five feet in circumference. The trees also grow abundantly in Judea, and there are some still standing in the garden of Gethsemane, which are so large and old that they are thought to have been in existence ever since

the time of our Saviour. Josephus tells us that when Titus destroyed Jerusalem, he cut down all the trees within one hundred furlongs of the city; still it is very probable that these trees may have grown up from the roots of the old ones, because it is quite a characteristic of the olive-tree to shoot up again, however frequently it may be cut down. They are wild olives of extreme old age, and their stems quite rough and gnarled. The leaves of the tree are evergreen, stiffish and pointed; the flowers white, growing in clusters, succeeded by an oval *drupe*, or plum, which is violet-colored when ripe, bitter and nauseous. The preserved olives, common as a table luxury, are the unripe fruit pickled in a strong solution of salt. Salad oil is made from olives. The ripe fruit is gathered in November, and bruised in a mill, the stones of which are set so wide apart as not to bruise the nut or kernel; the pulp is then gently pressed in bags made of rushes; the first oil that flows is of the most value, a second quality is obtained by breaking the refuse, mixing it with warm water, and returning it to the press; and after this a third very inferior kind is obtained.

Limes.—The little island of Montserrat, one of the most charming and salubrious of the British West Indian Colonies, with an area of but forty-seven square miles, or considerably less than that of London, contains the most extensive and best cultivated plantations of the lime-fruit tree in the world. The cultivation of the plant, which involves a large outlay of capital, with no immediate return, was not at first attended with any commercial success, but the Montserrat Company now owns six hundred acres of land, bearing one hundred and twenty thousand trees, from which a crop is gathered nearly all the year round, the heaviest harvest extending for three months, from September to January. The appearance of the trees—with their dark-green leaves growing thick and bushy, and relieved at one and the same time by the bright fruit in different stages of ripeness, from green to a rich, ruddy yellow, and by the fragrant white flowers, resembling orange blossoms—is one of extreme beauty, and a lime-tree orchard is perhaps unequaled by any other similar plantation. The very leaves of the tree emit a delicious perfume, and are largely used in the West Indies for the purpose of scenting water for toilet and other purposes. The trees do not bear fruit till they are seven years old, and during that period they require careful attention and pruning; they are otherwise easy of cultivation, flourishing best in light soils near the sea. The production of fruit is very large; and the process of extracting the juice is easy, the fruit being simply sliced and pressed, and the juice at once placed in casks ready for exportation. A secondary product is citric acid, which is procured from the inferior fruit, and by a subsequent manipulation of the refuse from the first process of squeezing.

The Jak Tree.—The bread-fruit tree, originally found in the southeastern parts of Asia and the islands of the Pacific, though now introduced into the tropical parts of the western continent and the West Indies, is one of the most interesting as well as singular productions of the vegetable kingdom. There are two species of it—the bread-fruit, properly so called, with the leaves deeply gashed, or divided at the sides, which grows chiefly in the islands, and the jack-fruit, or jak tree, which grows chiefly in the main land of Asia.

The bread-fruit is as beautiful as well as a useful tree; the trunk rises to a height of about forty feet, and in a full-grown tree is from a foot to fifteen



THE JAK TREE.

inches in diameter; the bark is ash-colored, full of little chinks, and covered by small knobs; the inner bark is fibrous, and used in the manufacture of

a sort of cloth; and the wood is smooth, soft, and of a yellow color; the branches come out in a horizontal manner, the lowest ones about ten or twelve feet from the ground, and they become shorter and shorter as they are nearer the top. The leaves are divided into seven or nine lobes, about eighteen inches or two feet long, and are of a lurid green. The tree bears male and female flowers—the males among the upper leaves, and the females at the extremities of the twigs. When full-grown, the fruit is about nine inches long, heart-shaped, of a greenish color, and marked with hexagonal warts, formed into facets. The pulp is white, partly farinaceous and partly fibrous; but when quite ripe it becomes yellow and juicy. The whole tree, when in a green state, abounds with a viscid, milky juice, of so tenacious a nature as to be drawn out in threads.

The bread-fruit tree continues productive for about eight months in the year. Such is its abundance that two or three trees will suffice for a man's yearly supply, a store being made into a sour paste called *make* in islands, which is eaten during the unproductive season. When the fruit is roasted until the outside is charred, the pulp has a consistency not unlike that of wheaten bread, and the taste is intermediate between that of bread and roasted chestnuts. It is said to be very nourishing, and is prepared in various ways. The *jak*, or *jack*, grows to the same or even to a larger size than the bread-fruit of the Society Islands, but it is neither so palatable nor so nutritious. The fruit often weighs more than



TWINING HYACINTH OF CALIFORNIA.

thirty pounds, and contains two or three hundred seeds, each of them four times as large as an almond. December is the time when the fruit ripens; it is then eaten, and the seeds or nuts also are eaten, after being roasted. There are many varieties of the jak tree, some of which can hardly be distinguished from the seedling variety of the true bread-fruit. The fruit, and also the part of the tree in which it is produced, vary with the age. When the tree is young, the fruit grows from the twigs; in middle age it grows from the trunk, and when the tree gets old it grows from the roots.

Twining Hyacinth of California.—Our engraving represents a wonderfully singular and beautiful plant, which grows among the moun-



THE BIG TREES OF CALIFORNIA.

tains of California. It twines itself into and around every bush or shrub within its reach, and does not stop climbing till its slender stem has reached the top of its support, even if it should be ten feet high. When it has gained the top, it seems to rest for a while as if to look about it and feel sure of its position, then lets go its hold upon the earth, and without any connection with the ground, or any sustenance from it, goes on blooming and ripening its seed, month after month, no more affected apparently, by the

scorching heat of the sun by day, nor the chill of the mountain air by night, than if it had an anchoring root like an oak tree. The leaves are long and narrow, resembling blades of grass; the flowers are a fine pink, or deep rose color, and as you may judge from the picture, very beautiful. This strange plant blooms constantly from May to September.

The Big Trees of California.—The mammoth evergreen and red-wood trees of California have a world-wide notoriety. They are found in small groves in the Sierra Nevada Mountains, at a height of four thousand five hundred feet above the sea level. In Calaveras County there is a grove of one hundred and three trees, each of which measures from seventy to

ninety-three feet in circumference. The grove in Mariposa County contains one hundred and thirty-four trees of over fifteen feet in diameter, many of them being from twenty-five to thirty-five feet, and nearly three hundred smaller ones. The Tulare-Fresno forest, which is seventy miles long and about ten miles wide, consists mainly of these mammoth trees. On one occasion ten men on horseback attempted to form a circle around one of them. Each horse stood with his head close to the tail of the one before him, yet they reached but half way round the tree. The height of the largest trees is from three hundred to four hundred feet, and some of those that have been felled indicate an age of from two thousand to three thousand years.

The Ivory Plant.—So different are the products of the animal from those of the vegetable kingdom, that even the most careless observer may be expected at once to distinguish them. Yet multitudes are in the daily use of ivory buttons, boxes and small ornaments, who never doubt that they are made from the tusks of the elephant, while they are really the product of a plant. The ivory plant is a native of the northern regions of South America, extending northward just across the Isthmus of Panama, large groves of it having been recently discovered in the province of that name. It is found in extensive groves—in which it banishes all other vegetation from the soil it has taken possession of—or scattered among the large trees of the virgin forests. It has the appearance of a stemless palm, and consists of a graceful crown of leaves, twenty feet long, of a delicate pale green color, and divided like the plume of a feather into from thirty to fifty pairs of long narrow leaflets. It is not, however, really stemless, but the weight of the foliage and the fruit is too much for the comparatively slender trunk, and consequently pulls it down to the ground, where it is seen like a large exposed root, stretching for a length of nearly twenty feet in the old plants. The long leaves are employed by the Indians to cover the roofs of their cottages.

Each flower of the ivory plant does not contain stamens and pistils, as in most of the British plants, but like our willows, one tree produces only staminal flowers, while another has only pistillate ones. Such plants are said by botanists to be diœcious. Both kinds of the plants of the vegetable ivory have the same general appearance, and differ only in the form and arrangement of the flowers. In the one kind an innumerable quantity of staminal flowers is born on a cylindrical fleshy axis, four feet long, while in the other a few pistillate flowers spring from the end of the flower-stalk. Each plant bears several heads of flowers. Purdie, who visited the plants in their native locality in 1846, says: "The fragrance of the flowers is most powerful, and delicious beyond that of any other plant, and so diffuse, that the air for many yards around was alive with myriads of annoying insects, which first attracted my notice. I had afterwards to carry the flowers in my hands for twelve miles, and though I killed a number of insects that followed me, the next day a great many still hovered about them, which had come along with us from the wood where the plant grew. The group of pistillate flowers produce a large roundish fruit, from eight to twelve inches in diameter, and weighing when ripe about twenty-five pounds. It is covered by a hard woody coat, everywhere embossed with conical angular tubercles, and is composed of six or seven portions, each containing from six to nine seeds. These seeds, when ripe, are pure white, free from veins, dots, or vessels of any kind, presenting a perfect uniformity of texture surpassing

the finest animal ivory; and its substance is throughout so hard that the slightest streaks from the turning-lathe are observable. Indeed, it looks much more like an animal than a vegetable product; but a close comparison will enable one to distinguish it from the ivory of the elephant by its brightness and its fatty appearance, but chiefly by its minute cellular structure. This curious hard material is the store of food laid up by the plant for the nourishment of the embryo, or young plant contained in the seed. It corresponds to the white of an egg of the hen, and has been consequently called the albumen of the seed. In its early condition this ivory exists as a clear



THE IVORY PLANT.

insipid fluid, with which travelers allay their thirst; afterwards the liquor becomes sweet and milky, and in this state it is greedily devoured by bears, hogs and turkeys; it then gradually becomes hard. It is very curious that this hard mass again returns to its former soft state in the process of germination. The young plant for some time is dependent upon it for its food, and if the seed be taken out of the ground after the plant has appeared, it will be found to be filled with a substance half pulp and half milk, on which the plant lives until it is old enough to obtain its food on its own account.

From the small size of the seed, the largest not being more than two

inches across its greatest diameter, the vegetable ivory can be employed in the manufacture of only small articles, such as beads, buttons, toys, etc. What is wanting in size is, however, often made up by the skill and ingenuity of the workmen, who join together several pieces so as to make a



THE BETEL NUT TREE.

long object, when it is easy to hide the joints from view, or make a lid from one seed, and the box from another.

The Betel-Nut Tree.—The betel-nut tree is one of the most graceful of the palm tribe. It is a native of all the countries of Asia within the

tropics, and is cultivated all over India for the sake of the nut, which is in high esteem. It grows to a height of forty or fifty feet, begins to bear fruit at five years, and continues in bearing for sixty or seventy years; but when it has been twenty-five or thirty years in perfection it begins to decay. The tree is in flower most of the year. The nut is about the size of a hen's egg, enclosed in a membranous covering, and of a reddish yellow when ripe. There are two crops in the year. The quantity of nuts yielded by a single tree varies considerably in different places; on the Coromandel coast the average number of nuts obtained from a single tree is usually about three hundred. The betel-nut is dried, cut into slices, usually four; these slices are wrapped up in the leaf of the black pepper vine and sprinkled with quicklime. Thus prepared, it is chewed, and is enjoyed by the people as a universal luxury.

The Cow Tree.—Alexander Humboldt remarks that among the many very wonderful natural phenomena which he had during his extensive travels witnessed, none impressed him in a more remarkable degree than the sight of a tree yielding an abundant supply of milk, the properties of which seemed to be the same as the milk of a cow. The adult Indians would go each morning with their slaves from the village or station on the slope of the mountain chain bordering on Venezuela, where Humboldt was stopping, to a forest where they grew, and making some deep incisions into the trees, in less than two hours their vessels, placed under these incisions, would be full. All present would then partake of the milk, on which the slaves grew fat, and a quantity would be carried home to be given to the children and to be mixed with cassava and maize. The tree itself attains a height of from forty-five to sixty feet, has long alternate leaves, and was described by Linden as *Brosimum galactodendron*. The milk which flows from any wound made in the trunk is white and somewhat viscid; the flavor is very agreeable. An analysis of the substance made several years ago by M. Boussingault, a French chemist, shows that this vegetable milk most certainly approaches in its composition to the milk of the cow; it contains not only fatty matter, but also sugar, caseine and phosphates. But the relative proportion of these substances is greatly in favor of the vegetable milk, and brings it up to the richness of cream, the amount of butter in cream being about the same proportion as the peculiar waxy material found in the vegetable milk, a fact that will readily account for its great nutritive powers.

The Soap Plant.—A species of cacti called *Amole* is found in various parts of the American continent from Mount Shasta on the north to a similar latitude in South America, and from the Pacific Coast to east of the Rio Grande, through New Mexico and Western Texas. The flower stalks are destitute of leaves, but are plentifully supplied with branches about eighteen inches long, from which flowers of white and yellow color are suspended in the flowering season. The bulbous root is from one to six inches in diameter and from six to eighteen inches long. A saponaceous juice is pressed from the root, and the fibre of the leaves is heckled for the manufacture of mattresses, cushions, and chair seats. The vegetable soap extracted from the root has been used by the Indians, Mexicans, and others for many years as a hair wash, and exceeds in purity our manufacture from animal substances. The preservative qualities of the soap are well known, and its use gives the hair a fine natural glow, and prevents decay.

The Talipat Palm Tree.—The Talipat or Great Fan Palm is the noblest palm of the East Indies, a native of Ceylon, Malabar, etc. It grows



THE TALIPAT PALM TREE.

to the height of sixty, seventy, or even one hundred feet, and has a straight cylindrical trunk, crowned with a tuft of enormous palmate plaited leaves, which are divided near the outer margin into numerous segments, and are

united to the trunk by spiny leaf-stalks. The leaves are usually about eighteen feet long, exclusive of the leaf-stalk, and fourteen feet broad; a single one being sufficient to protect fifteen to twenty men from rain. At the age of thirty or forty years, the tree flowers, and after ripening fruit, generally dies. It produces a long conical erect spadix, rising to the height of thirty feet from the midst of its crown of leaves, and dividing into simple alternate branches, the lower of which sometimes extend laterally twenty feet, the whole covered with whitish flowers, and forming a very beautiful and magnificent object. The fruit is very abundant, globose, and about an inch and a half in diameter. The leaves are used for covering houses, for making tents, and for many other purposes. On occasions of ceremony, every Cingalese noble is followed by an attendant, who carries above his head a richly ornamented palm leaf, which is capable of being folded up like a fan, and is then not thicker than a man's arm, and wonderfully light. The leaves of this palm are used in Malabar for writing upon, characters being traced upon them with an iron style. They are prepared for this purpose by boiling, drying, damping, rubbing, and pressing. The soft central part of the stem, pounded and made into bread, has often been of great use in times of scarcity.

The Bamboo.—This is a genus of grasses, of which most of the species attain a great size, many of them twenty or thirty feet, some seventy or one hundred feet in height. The species are numerous, and are found in tropical and subtropical regions, both of the eastern and western hemispheres. They are of great importance to the inhabitants of the countries in which they grow. All of them have a jointed subterranean root-stock which throws up stems from ten to one hundred feet high. These are generally straight and erect; although one large species (*B. agrestis*), common in dry mountainous situations in the south-east of Asia, has crooked, and sometimes creeping stems. The stems grow to their full height unbranched, but afterwards throw out straight horizontal branches, especially in their upper parts, forming a dense thicket. Some of the smaller kinds are often planted as hedges. The stems are jointed like those of other grasses, very hard, but light and elastic, hollow, containing only a light spongy pith, except at the joints or nodes, where they are divided by strong partitions. They are, therefore, readily converted into water-vessels of various sorts; and when the partitions are removed, they are used as pipes for conveying water. They are also much employed for house-building, for bridges, etc. The smaller stems are converted into walking-sticks, and are exported under the name of bamboo cane. In China, the interior portions of the stem are used for making paper. The stems of different species vary very much in the thickness of the woody part, and so in their adaptation to different purposes. The external covering of the stem is, in all the species, remarkably silicious; the stem of *B. tabacaria* is so hard that it strikes fire when the hatchet is applied. This species is a native of Amboyna and Java; its slender stems are polished, and used for the stalks of tobacco-pipes. The leaves of some kinds are used for thatch, and the Chinese plait hats of them; of the external membrane of the stems of some, they make paper. From the knots of the bamboo there exudes a saccharine juice, which dries upon exposure to the atmosphere, and which the Greeks call *Indian Honey*. The young shoots of some kinds of bamboo are eaten like asparagus, or are pickled in vinegar. Those of *B. Tulda*, a common Bengalese species, are used for these purposes when about two feet

long. The seeds of some species are used as rice, and for making a kind of beer. Bamboos are generally of very rapid growth, and they are often found in arid situations, which would otherwise be destitute of vegetation.

The Star Fish Cactus.—All plants of the cactus kind are so wonder-



THE BAMBOO.

fully made that they are able to bear the heat and dryness of very hot climates without showing any evil effects. They draw in the heavy dews that fall at night, literally drink them in, and then, when the heat of the day comes on, this moisture supports the plant, and gives it health and strength.

Flowers often grow out of the cacti in a very unexpected fashion and of very



THE STAR FISH CACTUS.

curious forms. We give an illustration of a variety, whose flower very much resembles a starfish.

A Peruvian Forest.—Peru is exceedingly rich in vegetable production, and each of its natural regions has its own flora. The coast district has not many plants, but east of the Andes the species are exceedingly numerous. Many species of medicinal herbs, and a great variety of aromatic balsams, oils, and gums are produced. Trees and shrubs which yield seven different kinds of wax are known, and, according to Peruvian writers, this territory is a new world in itself. Almonds, ginger, the balsam of copaiba, gum copal, etc., are all said to abound. On the coasts, and the west slopes of the Andes, are produced the cabbage-palm, the cocoanut, the chocolate-nut, the cotton shrub, the pineapple, tumeric, plaintain, and



A PERUVIAN FOREST.

sugar-cane, besides some trees that have only Peruvian appellations. The *coffea racemosa* is found in the interior, and the berries are used in the same way as those of the cultivated species. The large flowered jasmine, and the *datura arborea* are very abundant in the vicinity of Lima, and are much used by the women for wreaths, and for braiding in their hair. No fewer than twenty-four species of pepper, and five or six of capsium are reckoned natives; there are several species of *solanum*, or plants of the potato genus, and the potato commonly called the Irish was originally brought from Peru. Tobacco and jalap are abundant in the groves at the foot of the mountain; and many of the varieties cultivated in the green-houses and gardens in other countries grow wild in the forests. Cotton is

found in great abundance in a wild state on the banks of the Amazon and its tributaries. Among the numerous shrubs which clothe the highlands, the different species of cinchona or Peruvian bark are the most valuable. It is scattered along the skirts of the Andes over an extent of 2,000 miles, at an elevation of from 2,800 to 9,500 feet, and therefore thrives in a great variety of climates. On the east declivity of the Andes it forms a continued forest for many miles. Caoutchouc is procured from the inspissated juices of a variety of different plants. The tree-ferns range between one thousand five hundred and five thousand feet above the sea; beyond the height of ten thousand five hundred feet arborescent vegetables disappear; between six thousand five hundred and thirteen thousand five hundred feet the Alpine plants are found; species of the *Wintera* and *Escallonia* occur between nine thousand two hundred and ten thousand eight hundred feet, and form scrubby bushes in the cold and moist climate.

The Laughing Plant.—In Palgrave's "Central and Eastern Arabia" we are told some interesting facts concerning this singular plant. The active principle appears to reside principally in the seeds. These seeds, when powdered and administered in full judicious quantities, produce effects similar to those produced by laughing gas. The person to whom the drug is administered laughs, sings, dances, and conducts himself in the most extravagant and ludicrous style. After an hour of this intense excitement he falls asleep; and upon awaking, he is totally unconscious of anything that he said or did while under the influence of the drug. It is a common joke to put a small quantity into the coffee of some unsuspecting individual, in order to enjoy a laugh at his antics; and it is said that, when judiciously given, it has never produced any evil consequences. An overdose would be dangerous. The plant which bears these berries grows only in Arabia. In Kascem it hardly attains the height of six inches above the ground, while in Oman it has reached the height of three or four feet, with wide-spreading limbs. The stems are woody, and when stripped of the bark have a yellowish tinge; the leaf is of a dark-green color, and pinnated with about twenty leaflets on either side; the stalks are smooth and shining; the flowers are yellow, and grow in tufts, and the anthers numerous. The fruit is a capsule, stuffed with a greenish padding, in which lie embedded two or three black seeds, in size and shape much like French beans. Their taste is sweetish, but with a peculiar opiate flavor. The smell is overpowering and almost sickly.

The Fountain Tree.—These are very extraordinary vegetables, growing in one of the Canary Islands, and likewise said to exist in some other places, which distill water from their leaves in such plenty as to answer all the purposes of the inhabitants who live near them. Of these trees we have the following account, in Glasse's "History of the Canary Islands": "There are three fountains of water in the whole island of Hiero, wherein the fountain tree grows. The larger cattle are watered at those fountains, and at a place where water distills from the leaves of a tree. Many writers have made mention of this famous tree, some in such a manner as to make it appear miraculous; others again deny the existence of any such tree, among whom is Father Feyjoo, a modern Spanish author. But he, and those who agree with him in this matter, are as much mistaken as those who would make it appear to be miraculous. The author of the 'History of the Discovery and Conquest' has given us a particular account of it, as follows:

“ ‘The district in which this tree stands is called Tigulabe; near to which, and in the cliff or steep rocky ascent that surrounds the whole island, is a gutter or gully, which commences at the sea, and continues to the summit of the cliff, where it joins or coincides with a valley, which is terminated by the steep front of a rock. On the top of this rock grows a tree, called, in the language of the ancient inhabitants, *garse*, sacred or holy tree, which for many years has been preserved sound, entire, and fresh. Its leaves constantly distill such a quantity of water as is sufficient to furnish drink to every living creature in Hicro, nature having provided this remedy for the drought of the island. It is situated about a league and a half from the sea. Nobody knows of what species it is, only that it is called *til*. It is distinct from other trees, and stands by itself. Its fruit resembles the acorn, and tastes something like the kernel of a pineapple, but is softer and more aromatic. The leaves of this tree resemble those of the laurel, but are larger, wider, and more curved; they come forth in a perpetual succession, so that the tree always remains green. Near to it grows a thorn, which fastens on many of its branches, and interweaves with them; and at a small distance from the *garse* are some beech-trees, bresoes, and thorns. On the north side of the trunk are two large tanks or cisterns, of rough stone, or rather one cistern divided, each half being twenty feet square, and sixteen spans in depth. One of these contains water for the drinking of the inhabitants; and the other, that which they use for their cattle, washing, and such like purposes.

“ ‘Every morning, near this part of the island, a cloud or mist arises from the sea, which the south or easterly winds force against the forementioned steep cliff; so that the cloud, having no vent but by the gutter, gradually ascends it, and from thence advances slowly to the extremity of the valley, where it is stopped and checked by the front of the rock which terminates the valley, and then rests upon the thick leaves and wide spreading branches of the tree, from whence it distills in drops during the remainder of the day, until it is at length exhausted, in the same manner that we see water drip from the leaves of trees after a heavy shower of rain.

“ ‘This distillation is not peculiar to the *garse* or *til*, for the bresoes, which grow near it, likewise drop water; but their leaves being but few and narrow, the quantity is so trifling, that, though the natives save some of it, yet they make little or no account of any but what distills from the *til*, which, together with the water of some fountains, and what is saved in the winter season, is sufficient to serve them and their flocks. A person lives on the spot near which this tree grows, to take care of it and its waters, and is allowed a house to live in, with a certain salary. He every day distributes to each family of the district seven pots or vessels full of water, besides what he gives to the principal people of the island.’ ”

The Groaning Tree.—The history of the groaning tree is this: About forty years ago a cottager who lived near the center of the village of Badesley, near Lymington, England, heard frequently a strange noise behind his house, like that of a person in extreme agony. Soon after it caught the attention of his wife, who was then confined to her bed. She was a timorous woman, and, being greatly alarmed, her husband endeavored to persuade her that the noise she heard was only the bellowing of the stags in the forest. By degrees, however, the neighbors on all sides heard it, and the thing began to be much talked of. It was by this time plainly discovered that the groaning noise proceeded from an elm which grew at the end of the garden.

It was a young, vigorous tree, and to all appearance perfectly sound. In a few weeks the fame of the groaning tree was spread far and wide, and people from all parts flocked to hear it. Among others it attracted the attention of the then Prince and Princess of Wales, who resided at that time, for the advantages of a sea-bath, at Pilewell, the seat of Sir James Worsley, which stood within a quarter of a mile of the groaning tree. Though the country people assigned many superstitious causes for this strange phenomenon, the naturalists could assign no physical one that was in any degree satisfactory. Some thought it was owing to the twisting and friction of the roots. Others thought it proceeded from water which had collected in the body of the tree, or perhaps from pent air. But no cause that was alleged appeared equal to the effect. In the meantime the tree did not always groan, sometimes disappointing its visitants; yet no cause could be assigned for its temporary cessations, either from seasons or weather. If any difference was observed, it was thought to groan least when the weather was wet, and most when it was clear and frosty; but the sound at all times seemed to arise from the root. Thus the groaning tree continued an object of astonishment, during the space of eighteen or twenty months, to all the country around; and, for the information of distant parts, a pamphlet was drawn up containing a particular account of all the circumstances relating to it. At length the owner of it, a gentleman by the name of Forbes, making too rash an experiment to discover the cause, bored a hole in its trunk. After this it never groaned. It was then rooted up, with a further view to make a discovery; but still nothing appeared which led to any explanation of the cause. It was universally believed, however, that there was no trick in the affair, but that some natural cause really existed, though never understood.

The Whistling Tree.—In Nubia and the Soudan groves a species of acacia is described as existing, whose scientific appellation, as well as its popular name, is derived from a peculiar sound emitted by the branches when swayed by the wind. The Arabic name is the “soffa,” or pipe, and the specific name of *fīṣūla*, also meaning a pipe, has been given to it for the same reason which prompted the natives to give it its local designation. The tree is infected with insects, whose eggs are deposited in the young shoots and extremities of the branches. A sort of gall-like excrecence about an inch in diameter is produced at the base of these shoots, and when the larva has emerged from this nidus, it leaves a small circular hole, the action of the wind in which causes it to produce a whistling sound like that produced by a flute or by blowing into any hollow pipe. When the wind is violent, the noise caused by thousands of these natural flutes in a grove of acacias is most remarkable. The description given by Dr. Schweinfurth of these bladder-like galls leaves it uncertain whether they are true gall-nuts or whether they are the secretion of a species of lac insects. The valuable Indian lac insect thrives on two or three species of acacia, while one variety (the *A. Arabica*) also produces a pod or gall-nut, which is useful for tanning. In either case, these natural “whistles” of the whistling tree would form a valuable article of commerce if they could be easily and regularly collected and exported.

The Banyan Tree.—This tree, a native of India, is remarkable for its vast rooting branches. It is a species of fig; has ovate, heart-shaped, entire leaves, about five or six inches long, and produces a fruit of a rich scarlet color, not larger than a cherry, growing in pairs from the axils of the

aves. The branches send shoots downwards, which, when they have rooted, become stems, the tree in this manner spreading over a great surface, and enduring for many ages. One has been described as having no fewer than three hundred and fifty stems, equal to large oaks, and more than three thousand smaller ones, covering a space sufficient to contain seven thousand people. The branches are usually covered with monkeys, birds, and enormous bats. The monkey seat both the fruit and leaves. The vegetation of the banyan seldom begins on the ground. The seeds are deposited by birds in the crowns of palms, and send down roots which embrace and eventually kill the palm. As the banyan gets old, it breaks up into separate masses, the original trunk decaying, and the props becoming separate trunks of the different portions. The wood of the banyan is light, porous, and of no value. The bark is regarded by the Hindoo physicians as a powerful tonic, and is administered in diabetes. The white, glutinous juice is used to relieve toothache, and also as an application to the soles of the feet when in-



THE BANYAN TREE.

flamed. Bird lime is also made from it. The banyan tree is beautifully described by Southey in his poem, "The Curse of Kehama."

The Tallow Tree.—This is a remarkable tree, growing in great plenty in China, so called from its producing a substance like tallow, and which serves for the same purpose; it is about the height of a cherry tree, its leaves in form of a heart, of a deep shining red color, and its bark very smooth. Its fruit is inclosed in a kind of pod, or cover, like a chestnut, and consists of three round white grains, of the size and form of a small nut, each having its peculiar capsule, and a little stone within. This stone is encompassed with a white pulp, which has all the properties of true tallow, both as to consistence, color, and even smell, and accordingly the Chinese make their candles of it. All the preparation they give it is to melt it down, and mix a little oil with it, to make it softer and more pliant. The candles made of it yield a thicker smoke and a dimmer light than do those made from animal tallow; but those defects are owing in a great measure to the wicks, which are not of cotton, but only a little rod of dry light wood, covered with the pith of a rush wound round it, which, being very porous, serves to filtrate the minute parts of the tallow, attracted by the burning stick, and by this means is kept alive.

The Paper Tree.—The name of this tree is *Aouta*. It is a mulberry-tree, found at Otaheite, in the South Sea, from which a cloth is manufactured that is worn by the principal inhabitants. The bark of the tree is stripped off, and deposited to soak in running water; when it is sufficiently softened, the fibres of the inner coat are carefully separated from the rest of the bark; they are then placed in lengths of about eleven or twelve yards, one by the side of another, till they are about a foot broad; and two or three layers are put one upon another. This is done in the evening; and next morning the water is drained off, and the several fibres adhere together in one piece. It is afterwards beaten on a smooth piece of wood with instruments marked lengthways, with small grooves of different degrees of fineness; and by means of this it becomes as thin as muslin. After bleaching it in the air, to whiten it, it is fit for use.

The Stinging Tree.—The "stinging tree" of Queensland is a luxurious shrub, pleasing to the eye but dangerous to the touch. It grows from two or three inches to ten or fifteen feet in height, and emits a disagreeable odor. Says a traveler: Sometimes while shooting turkeys in the scrubs, I have entirely forgotten the stinging tree until warned of its close proximity by its smell, and have often found myself in a little forest of them. I was only once stung, and that very lightly. Its effects are curious; it leaves no mark, but the pain is maddening; and for months afterward the part when touched is tender in rainy weather, or when it gets wet in washing, etc. I have seen a man who treats ordinary pain lightly roll on the ground in agony after being stung, and I have known a horse so completely mad after getting into a grove of the trees that he rushed open-mouthed at every one who approached him, and had to be shot. Dogs, when stung, will rush about whining piteously, biting pieces from the affected part.

Mahogany.—The mahogany tree is found in Florida, and may thus be claimed as indigenous to the United States; and there is no reason to doubt that it may and hereafter will be planted and cultivated to great advantage. But hitherto it has been cut chiefly in the native forests of the Bahamas, the

West India Islands, Honduras and Yucatan. Full-grown, it is one of the monarchs of the forests of tropical America. Its vast trunk and massive arms rising to a very lofty height, and spreading with graceful sweep over immense spaces—covered with beautiful foliage, bright, glossy, light and airy, clinging so long to the spray as to make it almost an evergreen—present a rare combination of loveliness and grandeur. The leaves are very small, delicate and polished like those of the laurel. The flowers are small and white, or greenish yellow. The fruit is a hard, woody capsule, oval, not unlike the egg of a turkey in size and shape, and contains five cells, in each of which are inclosed about fifteen seeds. The mahogany lumbermen, having selected a tree, surround it with a platform about twelve feet above the ground, and cut it above the platform. Some dozen or fifteen feet of the largest part of the trunk are thus lost. Yet a single log not unfrequently weighs from six or seven to fifteen tons, and sometimes measures as much as seventeen feet in length, and four and a half to five and a half feet in diameter, one tree furnishing two, three or four such logs. Some trees have yielded twelve thousand superficial feet, and at average piece prices have sold for \$15,000. Messrs. Broadwood, London, piano manufacturers, paid £3,000 for three logs, all cut from one tree, and each about fifteen feet long and more than three feet square.

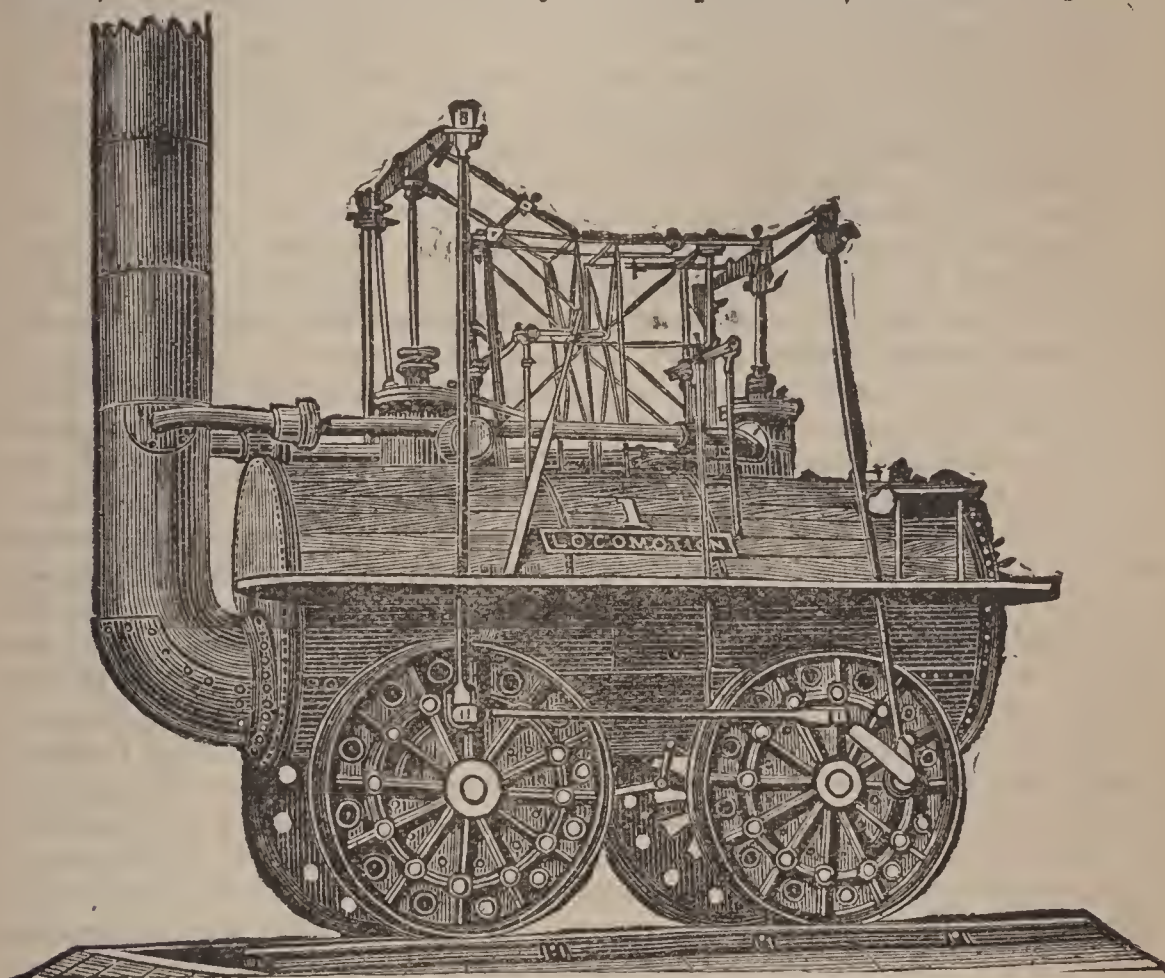
Rosewood.—It has puzzled many people to decide why the dark wood so highly valued for furniture should be called "rosewood." Its color certainly does not look much like a rose; so we must look for some other reason. Upon asking, we are told that when the tree is first cut, the fresh wood possesses a very strong rose-like fragrance—hence the name. There are a half dozen or more kinds of rosewood trees. The varieties are found in South America, and in the East Indies and neighboring islands. Sometimes the trees grow so large that planks four feet broad and ten feet in length can be cut from them. These broad planks are principally used to make the tops of pianofortes. When growing in the forest, the rosewood tree is remarkable for its beauty; but such is its value in manufactures as an ornamental wood that some of the forests where it once grew abundantly now have scarcely a single specimen. In Madras the government has prudently had great plantations of this tree set out, in order to keep up the supply.

GREAT INVENTIONS.

The Steam Engine.—The Marquis of Worcester is commonly regarded as the inventor of the steam engine; but perhaps the most that can be justly said is, that he was the first person who imagined the possibility of constructing such a machine. The individual who actually first constructed an engine for raising water by the alternate force and condensation of steam, was Captain Savary, who published an account of his invention in a small tract, called the “Miner’s Friend.” In 1705, Newcomen obtained a patent for an improved steam engine, and in 1717 Henry Beighton made some further improvements, one of which is generally allowed to have been that of causing the steam cock to be opened and shut by the machinery—a man having been previously employed for the express purpose. A few other improvements were made by different persons, but they did not affect the general action of the engine; and although defects in its power had been noticed, their cause was unknown till 1765, when, happily for the prosperity of the arts and manufactures of Britain, the subject engaged the ingenuity of Mr. Watt. The model of a Newcomen’s engine fell into his hands to be repaired, and in this he presently observed the immense loss of steam occasioned by its admission into the cylinder, just cooled for condensations; indeed, he went so far as to ascertain by experiment that half the steam of the boiler was thus lost. But the circumstance that excited his greatest surprise was that the injection water gained infinitely more heat than if a quantity of boiling water, equal to that required to form the steam, had been added to it. In this dilemma, he is understood to have consulted the celebrated Dr. Black, whose discoveries on the subject of heat were then the theme of general wonder, and from him he obtained such an explanation of the difficulty as enabled him so to alter the construction of the engine, that with rather less than one-third of the quantity of steam it could produce the same power as one of equal dimensions on Newcomen’s plan. But great as was this improvement, it formed but a small part of the successful achievements of Mr. Watt in this department of mechanics. The application and utility of the engine he extended in various important ways, and at last arrived at that climax of improvement which consisted in making the steam serve to elevate as well as to depress the piston. An engine upon this plan, executed at Mr. Watt’s manufactory at Soho, near Birmingham, was first employed at the Albion Mills, in 1778.

George Stephenson is emphatically the engineer to whose intelligence and perseverance we owe the introduction of railroads into England, and consequently into the United States. It was at Killingworth Colliery that he constructed his first locomotive. At first, it was not very efficient; but, subsequently, the grand improvement of the “steam blast” carried his experiment to a triumphant issue. Further improvements followed, and in 1821 Stephenson was appointed engineer for the construction of the Stockton and Darlington Railway; the line, on its completion, being partially worked by means of his great invention. The rapid growth of the trade of South

Lancashire, together with the unpopular management of the Bridgewater Canal, gave rise, in 1821, to the project of a railway between Liverpool and Manchester. Stephenson was chosen engineer. That he proposed to work the line with an engine which was to go at the rate of twelve miles an hour, was a fact held up as of itself sufficient to stamp the project as a bubble. "Twelve miles an hour!" exclaimed the *Quarterly Review*—"as well trust one's self to be fired off on a Congreve rocket." When the bill ultimately passed, on 16th of March, 1826, Stephenson was appointed principal engineer, with a salary of £1,000 a year. After inconceivable difficulties, the line was completed in 1829. There then ensued the memorable competition of engines, resulting in the complete triumph of Mr. Stephenson's "Rocket," which, to the astonishment of every one except himself, was found capable



GEORGE STEPHENSON'S FIRST LOCOMOTIVE.

of traveling at the till then undreamt-of rate of thirty-five miles an hour. "Now," exclaimed one of the directors, "George Stephenson has at last delivered himself."

The first locomotive built in the United States was invented by the venerable Peter Cooper, of New York. His engine was built at the stage shops of Reedsides, Stockton & Stokes, in Baltimore; the foreman, Richard Imlay, being the directing mechanic. Mr. Reedsides remembers the trial trip made by Mr. Cooper with his engine to the Relay House and back. The boiler was not much larger than that of a modern kitchen range. It stood upright in the car, and the part above the furnace was filled with small vertical tubes. The cylinder was about three inches and a half in diameter, and the speed was gotten up by gearing. To create sufficient draft to

generate steam, a blowing apparatus was used. This was driven by a fly pulley passing over a drum, attached to one of the car wheels. Subsequently an open car was attached to the locomotive, which did not weigh more than a ton, and the directors and officers of the road were carried to Ellicott's Mills, Mr. Cooper acting as engineer and fireman. It is said that he made fifteen miles an hour. But the inventor was doomed to be greatly chagrined on this trip. Stockton and Stokes had two splendid gray horses hitched tandem to a car, waiting at the Relay House on one of the tracks for the return of Cooper's party from Ellicott's Mills. The race began, the start being even. The gray horses took the lead, and were soon nearly a quarter of a mile ahead; but by and by Mr. Cooper got steam up, and the iron horse began to gain, and with a wild hurrah Cooper's passengers as they swept by greeted those drawn by the horse team. Just then the band which drove the blowing apparatus slipped off the drum, and although Mr. Cooper mangled his hands vainly trying to readjust it, the steam went down, and Stockton's gray horses beat Cooper's iron horse into the city. The boiler of Cooper's engine is now in the shops of the Baltimore and Ohio Railroad at Mount Claire.

The Telegraph.—It has been reserved for our own day to develop into practical use the capabilities of electricity and magnetism as a means of distant communication; although in earlier times, the possibility of such a use of this natural power had been frequently suggested. The public use of the electric telegraph dates not earlier than 1844; but the idea that magnetism could be applied for distant communication is at least two centuries and a half old. Galileo, in one of his dialogues on the rival astronomical systems, written in 1632, puts in the mouth of one of his speakers, a reference to a secret art, by which, through the sympathy of a magnetic needle, it would be possible to converse across a space of two or three thousand miles. In 1753, a letter appeared in the *Scots Magazine*, bearing the initials C. M., and headed "An Expeditious Method of Conveying Intelligence," in which we must recognize the first perception of the uses to which telegraphy might be put. This interesting letter starts with the remark that it "is well known to all who are conversant in electric experiments, that the electric power may be propagated along a small wire from one place to another without being sensibly abated by the length of its progress;" and it goes on to describe an arrangement of wires corresponding in number to the letters of the alphabet, to be fixed in glass or jewellers' cement at intervals of twenty yards, and to convey, from an electric machine or rubber, a current which would lift each letter, "marked on bits of paper, or other substance that might be light enough" to rise to the electrified ball which formed the terminal of each wire. The apparatus proposed is crude and clumsy, yet we can hardly fail to recognize, in the letter of this man, the full appreciation of what the electric telegraph might become. From a period shortly anterior to the date of the letter in the *Scots Magazine*, down to 1837, a large number of proposals, more or less ingenious, are on record.

In the year 1832, Samuel F. B. Morse, an American artist and inventor, while on a voyage from Havre to New York, conceived the idea of a magnetic telegraph. He was at first laughed at as a man of visionary ideas, and "as crazy as old Morse" was a common epithet in those days. Having but scanty means, Professor Morse was unable himself to apply his invention, and for six years he vainly petitioned Congress to appropriate a sum sufficient to make the experiment. He struggled on until 1843, when, as he had

almost yielded to despair, Congress, at midnight, and the last moments of the session, appropriated \$30,000 for an experimental line between Washington and Baltimore. This line was completed in the following year, and the first message sent over it was: "What hath God wrought?" For his great invention, of such incalculable service to mankind, Professor Morse was rewarded by testimonials, honors, orders of nobility and wealth. Several European States joined in presenting him a purse of 400,000 francs, and banquets were given him in London and Paris.

An electric telegraph consists of three essential parts: 1, *the battery*, or source of electrical power; 2, *the wire*, or channel along which that power is conveyed to the required distant point; 3, *the instrument*, by which the electricity gives its signals, or makes evident to the observer its presence or absence, its direction or degree of intensity of action.

The leading principle in the Morse and other allied instruments is, that by the depression of a key or other method, an electric circuit is "closed" or completed, and a signal is transmitted along the wire to a distant station, where, on its arrival, it reproduces the signal by the action of an electro-magnet or otherwise. Electrically the Morse consists of the transmitting key and the electro-magnet and armature; while mechanically, it consists of a lever, with circular wheel or disc, attached to the armature, and a clock-work arrangement, by which the paper tape to be printed upon is carried forward under the disc. In the first Morse instruments the marks were made on the paper with a pointed style (the instrument being thus known as the *embosser*); but by the invention of the ink-writing arrangement of Siemens, the legibility and permanency of the record were secured, besides the advantage that a very light current will serve to make the marks. The passage of a current draws down the armature, and elevates the disc, causing a straight mark on the tape so long as the current flows. When it ceases, the spring draws back the armature and the mark is discontinued. Thus the duration of the current determines the nature of the mark, a momentary passage causing a dot and a longer depression of the key a dash. The Morse alphabet of dots and dashes is familiar to most readers.

The Printing Press.—Originating at the middle of the fifteenth, the art of printing continued to be conducted until the middle of the seventeenth century in a very clumsy manner. The press resembled a screw-press, with a contrivance for running the form of types under the point of pressure; force having been thus applied, the screw was relaxed, and the form withdrawn with the impression executed on the paper. The defects of this very rude mechanism were at length partially remedied by an ingenious Dutch mechanic, Willem Jansen Blaeu, who carried on the business of a mathematical instrument-maker at Amsterdam. He contrived a press in which the carriage holding the form was wound below the point of pressure, which was given by moving a handle attached to a screw hanging in a beam having a spring, which spring caused the screw to fly back as soon as the impression was given. This species of press, which was almost entirely formed of wood, continued in general use in every country in Europe till the beginning of the present century.

The first real improvement upon the printing press was made by the Earl of Stanhope. He constructed the press of iron, and that of a size sufficient to print the whole surface of a sheet, and he applied such a combined action of levers to the screw as to make the pull a great deal less laborious to the pressman, the mechanism altogether being such as to permit much

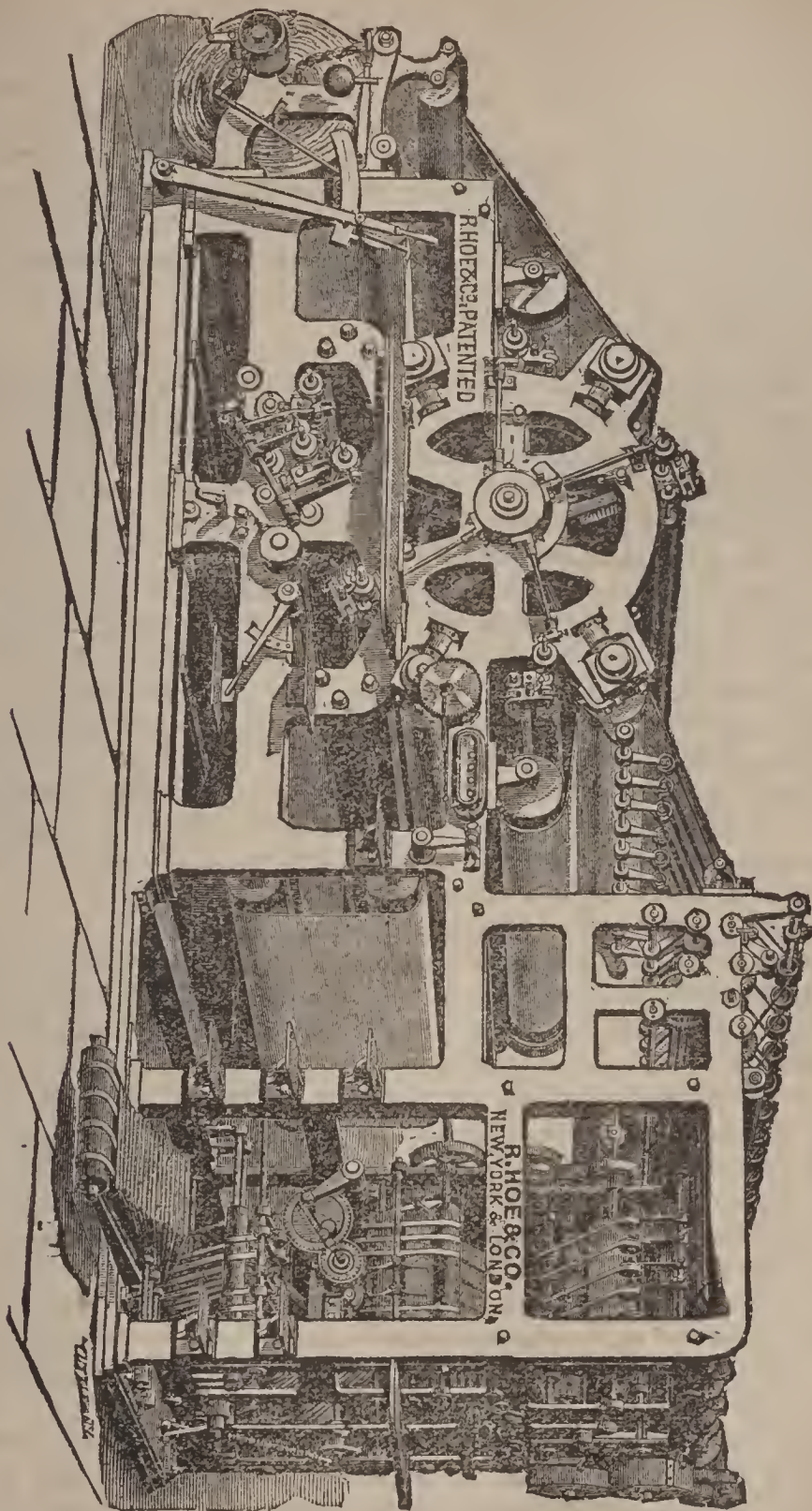
more rapid and efficient working. A multitude of improvements speedily succeeded that of Earl Stanhope, in most of which the screw was dismissed, the pressure being generally effected by levers, or by the simple and efficient principle of straightening a joint. The Columbian press, the invention of Mr. George Clymer, of Philadelphia, Pa., which was first exhibited in 1818, was a signal improvement upon all its predecessors. The pressing power in this instance is procured by a long bar or handle acting upon a combination of exceedingly powerful levers above the platen, the return of the handle or levers being effected by means of counter-poisés or weights.

Printing by hand-presses of an improved kind continues to be used in the case of limited impressions, or where extra care and elegance in typography are required; also where machinery is unattainable; but in general circumstances, and more particularly to meet the demand for popular reading, printing is now executed by one or other of the varieties of cylinder-presses, moved by steam-power. On approaching a cylinder press when at work, we perceive two cylinders, as large as hogsheads, revolving on upright supports; two smaller cylinders or drums revolving above them; and beneath, within the framework, a table, on which lie the types at both ends, going constantly backward and forward. A belt from a steam-engine, acting upon a shaft in the frame, gives motion to the whole apparatus. A boy, standing on the top of some steps, feeds in sheets of paper, each of which, on being delivered, is swept round the first cylinder (being held on by tapes), gets its impression below from the types, is carried over and betwixt the drums above, and then brought round on the second cylinder; now it gets its second side printed, and is delivered on a table completely printed. On minutely examining the parts, we observe that at each end there is an apparatus of rollers taking ink from a duetor or reservoir of that material, and placing it upon a portion of the moving table beneath; here other rollers distribute it, while others take it off and roll it upon the pages of types, ready for each impression. The cylinders have a continuous rotary motion towards each other, given by two large-toothed wheels, whilst the type carriages move backward and forward under them. The movements are so contrived that the type carriage shall have gone and returned to the same point during the period that the cylinders have made one entire revolution; consequently, each successive impression is taken from the types by the same part of each cylinder. The two drums placed between the cylinders are for the purpose of causing the sheet of paper to pass smoothly and accurately from one printing cylinder to the other. To preserve the sheet in its proper place on the cylinders, and carry it forward through the different parts of its journey, there is an extensive apparatus of tapes. These tapes are half an inch broad, and are formed into a series of endless bands, arranged at certain distances apart, so as to fall into the interstices and margins of the forms, and therefore escape being crushed between the types and the cylinders. The machine may be stopped at any instant by turning the handle of a lever.

Many years ago the fact became manifest that for daily newspapers of large circulation, the entire editions of which must be printed within a few hours, a press such as that just described was entirely inadequate. Recourse had to be made to an entirely new method of printing, the invention of which is due to Mr. Richard Hoe, of New York. Mr. Hoe's process consisted in placing the types (for which stereotype plates were afterward substituted) on a horizontal cylinder revolving on its axis, against which the sheets were pressed by exterior and smaller cylinders. The forms of type

occupied only a portion of the main cylinder, the remainder affording space for the inking apparatus. The smaller surrounding cylinders for effecting

A MODERN PRINTING PRESS.



the pressure were arranged in a framework, in connection with slopes, by which the sheets were fed in blank and came out printed on one side. The size of the main cylinder, the number of exterior cylinders, and the rate of speed determined the number of impressions printed per hour. Such was

the method of working Hoe's rotary machines, which, as wanted, were made with two, four, six, eight or ten subsidiary cylinders.

But Mr. Hoe's original invention, just described, was but the commencement of that state of perfection to which the art of newspaper printing has since attained. A modern newspaper printing-machine, such as that shown in our illustration, prints from a continuous roll of paper and from a single form of type, delivering the newspapers folded and ready for the reader at the rate of twenty-two thousand perfect papers per hour. Such a press weighs twenty-five tons, and contains five thousand separate pieces, and so accurately must each part be adjusted that three decimals, .001, are used in measurement. Over one hundred patents cover the mechanism of the machine, and the entire time of an army of workmen is employed for many months in the construction of one of them.

The Electric Light.—The following description of the Electric Light is extracted from "Gately's Universal Educator," by Professor Charles E. Beale and M. R. Gately (Boston, Mass.: M. R. Gately):

"When Faraday in 1846 made the discovery that light could be produced by the separation of two carbon rods conducting electricity of considerable intensity, the possibility of electric lighting on a large scale was first presented to the minds of scientists. The effect appeared due to the rarefaction of the air by the great heat of carbon in rapid combustion, and to the passage of incandescent particles of carbon from pole to pole, thus reducing the resistance always offered by air to the passage of electricity.

"Years spent in the study of the subject seem to have satisfied the advanced scientists that such a division of the electric light as would be necessary to the lighting of extensive areas was impossible; but fortunately there were men so little scientific in theory that they were not prevented from experimenting until they succeeded in producing practical results. And within a year, two classes of lights have been produced which seem specially adapted to the uses made of them.

The first is called the *arc-light*, and its principle has already been stated above as consisting in passing an electric current between two carbon points. In order, however, to produce an electric tension of sufficient force to allow any considerable sub-division of this light, it was necessary to invent powerful machines that would give a uniform motion to the current; and this has at last been accomplished in the *dynamo-electric* machine, and particularly that of Gramme. But, in order to use this machine, a gas or steam engine, or some mechanical power, is required to give rapid motion to the coils; and some of this power is lost in overcoming the friction of machinery, so that in no case can more than two-thirds of the force of the engine be utilized. Where water-power can be used, it will be most economical.

"On account of the great resistance offered by the atmosphere and carbons at the arc, the power of sub-division of the light is comparatively limited. In one light the candle-power may be as high as one-tenth of the number of foot-pounds of power employed; but when the attempt is made to divide a light—for instance, of four thousand candle-power into twenty arc-lights of two-hundred candle-power—it cannot be done, for much electromotive force presents itself at each arc in an opposite direction to the advancing current. A division can, however, be made with considerable loss of power at each arc, though the largest number of arc-lights yet produced by one machine is forty.

"The carbons which produce the arc-light are gradually consumed;

hence the space between the points would continually increase with loss of lighting-power were it not for a self-regulating apparatus, which keeps the points uniformly at the same distance apart. This light is said to show precisely the same spectrum as does sunlight, and is claimed to be identical in action.

“The coolness of the electric light is due to the absence of that large excess of less refrangible or heat-radiating rays, which is found nearly alike in all other modes of artificial lighting; and this absence of heat-rays is due to the almost perfect combustion of carbon material, and the consequent transformation of nearly all the heat, on account of its great intensity, into light. This light is used for lighting large areas, as streets of cities.

“The other class of electric light is simpler in construction and more direct in action. It is called the *incandescent light*. To produce this light, beside the usual generating machine and conducting wires, it is necessary to have at each lamp, to receive the current of electricity and transform it to heat and light, a rather poor conductor of electricity formed into a wire loop or curve; and it must be either non-combustible in air, or unchangeable in a vacuum. Carbon seems to be the best substance for this purpose, because, as compared with the only other substance, platinum, which can be used in this way, it is infusible. It has, however, been found difficult to manage, on account of its combustibility; yet, by repeated experiments and indomitable perseverance, Mr. Edison, of New York, and Mr. Swan, of England, at about the same time, succeeded in producing lamps which give satisfaction to all who use them. The lamps are substantially the same in principle, though Mr. Edison’s proves more durable; Mr. Swan using a fine carbonized paper filament, while Mr. Edison’s lamp consists of a single curl or loop of carbonized bamboo, no thicker than a hair, placed in an exhausted glass bulb. Notwithstanding the extreme fineness of the loop, it possesses the elasticity of a steel spring, and will endure electric currents of great force.

“These lamps were not serviceable at first, because the air was not sufficiently exhausted from the bulb and the carbons were soon consumed by oxidation; but a more perfect vacuum was finally formed by passing a greater current of electricity through the carbon in the bulb than it would subsequently be subjected to, and at the same time exhausting the air. The bulb is sealed while these actions are taking place.

“Each lamp is subjected to this process, and is made air and water tight. Each carbon, by a wire passing through the bottom of the lamp, is brought into connection with the conducting wires from the battery or dynamo-machine, upon screwing the lamp into a socket prepared for it. Apparatus has been invented by which the amount of electricity can be regulated, and the same effect produced as by partially turning on or off a current of gas in case of gas-light. In order to light a lamp it is only necessary to turn a cock exactly similar to a gas-cock, and matches are not required. The desirableness of this lamp consists not alone in its soft, clear light, but in its freedom from the heating and air-vitiating qualities of other artificial lights.

“The subdivision of this light is limitless, and depends only upon the *quantity* of electricity produced, and not upon the *tension* or *electro-motive* force, as does the arc-light. The success of this subdivision was only secured after numerous experiments, and yet, when obtained, seemed so simple that the inventor undoubtedly was vexed at his stupidity in not at once thinking of it; but it is one of the greatest accomplishments of the age.

“It is effected by running the conducting wires side by side and placing

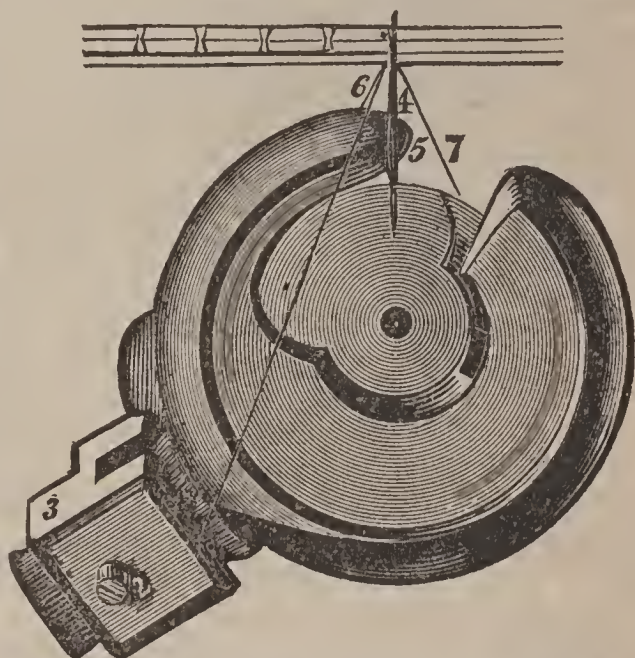
the lamps between them in connection with both, so that, as the electricity in quantity moves along the conducting wires, a sufficient amount passes into each lamp to produce the light, and the greater the quantity the brighter the light. It has been illustrated by one scientist in this way: Two canals conveying water are cut along the side of a hill, one above the other, at a distance of $\frac{1}{50}$ or $\frac{1}{100}$ of the height of the hill. The upper canal is connected with the lower at fifty or one hundred places by sluices, in each of which is a water-wheel; and, as the upper canal is always kept full, each sluice will have a sufficient quantity of water pass through it to the lower canal to keep its wheel running, and if any wheel gets out of order it in no way affects the others. Mr. Edison is now engaged in laying five hundred miles of underground mains in the city of New York, under agreement to furnish each dwelling with light at the same rate as gas is now furnished.

"The arc-lamp is more economical than the incandescent lamp for the reason that it admits of electrical action of greater intensity; thus producing heat of a higher temperature and lessening the quantity expended, while increasing the brilliancy of the light. As at present constituted, the carbons of the incandescent lamps will not endure the high temperature of the arc-lamps, hence require a greater quantity of electricity at a comparatively low temperature; but their construction will in time undoubtedly be so improved as to render them more economical.

"The incandescent light admits of unlimited sub-division, because the circuit is not broken; hence the resistance is only that of the conducting wires; while the arc-light is limited in division because it only acts by the breaking of the circuit. Mr. Brush, however, of the Brush Arc-Light Company, claims to have lately increased the power of his machines by so arranging the commutator as to cut off that portion of the wires which is inactive during polarization, thus reducing the resistance; and he also claims to have discovered a way by which he can store the superfluous electricity which his machine generates during the day, and make use of it during the night, so as not to necessitate the running of the machine at night."

The Sewing Machine.—Like the stocking-frame, which in principle it closely resembles, we owe the invention of the sewing machine to the ingenuity of a poor mechanic, striving to lessen the labor which he saw was a real hardship upon his wife and other poor women. Elias Howe, a native of Massachusetts, surrounded by a young family for whom he was obliged to labor during the day, devoted his after-hours to the construction of a sewing machine. This was about the year 1841, and his career since that period forms a striking chapter in the annals of intelligent labor, and furnishes another proof of the saying that "fact is stranger than fiction." After incessant labor, during the latter part of which he and his family were indebted to a friend for the means of subsistence, he completed the first working sewing machine, the patent for which was granted to him in May, 1841. He did not succeed in inducing the people of the United States to see the value of his patent, and came to England where, after patenting it there also, he met with so much discouragement that he sold the patent for £250 and a royalty of £3 per machine to a staymaker, Mr. Thomas, of Cheapside, London, who used it successfully in his own business, but did so little towards making it public that for several years its existence was only known to a very few individual manufacturers. When Howe reached his own country again, he found his American patent pirated by a wealthy company; but with admirable spirit he asserted his rights, and succeeded in establish-

ing them; and it is gratifying to know that his talent, industry and perseverance were rewarded, for he became a wealthy man. Howe's machine worked what is called the lock-stitch, but since his invention became known, numerous improvements and modifications have been introduced by other inventors. The principal of these are as follows: 1. *Machines which sew with one thread*; of which one kind makes the *through-and-through* or *shoemaker's stitch*, the thread being held and pushed through with pincers, one pair on each side of the material to be sewn. The needle is pointed at each end, and being pushed through by the pincers on one side, is taken hold of by the corresponding pair on the other, and the thread is thus pulled through backwards and forwards. Only a small length of thread can be used by this machine, hence it is of but limited application. 2. Another single-thread machine makes the *running-stitch*. In this, the needle is stationary, and receives a continuous supply of thread from a reel, the two small-toothed wheels are so arranged that their teeth, pressing into one another, crimp the two pieces of cloth, and push them forward against the point of the needle, which, as it gets filled, is relieved by the operator, who keeps drawing the sewn cloth off at the eye-end of the needle. This machine answers admirably in cases where loose tacking is required. It is the invention of an American of the name of Bostwick. 3. The *chain* or *tambour stitch* is also a single-thread stitch, the machine for which was invented by M. Thimmonier, a Frenchman, in 1848. In this, the thread is looped upon itself by means of a curved shuttle after it has passed through the cloth. This kind of stitch, though very useful for some kinds of work, is easily pulled out. 4. Wheeler and Wilson's is a double-thread machine, and besides the vertical eye-pointed needle, has a curved shuttle or hook working below, with a revolving reel inside its curve. The reel is of metal, each side being convex externally; and so adjusted on the axle that the edges are so near together as to admit only one thickness of the thread to pass through. It fits easily within the nearly circular hook, and gives off its thread as required. The thread passes partly round the outer edge of the hook upon a slightly grooved bevel which forms a loop, and passes it between the needle and the thread which it carries with it in descending; the loop is held in position as the needle ascends, and the cloth being moved on, the next descent of the needle takes it through the loop and receives another below it, which renders the first one tightly locked. Sewing machines have been patented in America and England by another American named Blake for sewing the soles on boots and shoes; and so rapid are they in their work, that it is said during the war in the United States as many as one hundred and fifty pairs of soles have been sewed on army boots in one day by a single



SHUTTLE OF THE WHEELER AND WILSON
SEWING MACHINE.

machine. Special sewing machines are also in use for sewing the upper leathers of boots and shoes, for gloves, for embroidery, and for various other purposes.

The Telephone.—This instrument is designed to convey sounds to a distance by electricity. Sound being propagated by vibration of air, the scientific requirement of the telephone is that it should, by the vibration of a tongue or membrane, represent different sounds; and to do this the currents of electricity must vary continuously in the proportion of the velocity of the movements of air producing the sounds. In the telephone of Reis, of Frankfort, produced in 1860, the “transmitter” consisted of a membrane which, by means of a simple contact-breaker, sent a series of currents along the line, producing in the “receiver” a series of ticks, their varying rapidity reproducing, though somewhat faintly, the quality and tone of the transmitted note. In 1874, Elisha Gray, of Chicago, adapted the telephonic principle to “multiplex” telegraphy over a single wire, the vibrations of a series of tuning forks affording the different tones in which several individual messages could be simultaneously sent. The telephone of A. Graham Bell, an Edinburgh gentleman resident in America, attracted much attention at the Philadelphia Centennial Exhibition. The transmitter shows a membrane, bearing on its center a small piece of iron, placed opposite the poles of an electro-magnet. The receiver, an upright tube enclosing an electro-magnet, has fixed on the top a thin disc of iron, left free to vibrate. The sounds are produced by the vibrations of this disc, corresponding to currents of electricity from the other end, sounds made before the transmitter being reproduced with startling fidelity. Speeches made and songs sung have been distinctly heard at a distance of eighteen miles; and in a paper read before the American Academy of Arts and Sciences in May, 1876, Mr. Bell stated that when two persons spoke before the transmitter, both sounds could be distinguished at the other end. The telephone has come into general use in all parts of the United States, and is undoubtedly one of the most important and valuable of modern inventions.

The Microphone.—This instrument, invented in 1878 by Professor Hughes, does for faint sounds what the microscope does for matter too small for sight—the fall of a bit of tissue paper or the tread of a fly being rendered audible at many miles distance. In principle the microphone illustrates the action of sonorous vibrations on the strength of an electric current. One of the most sensitive substances for microphonic action is willow-charcoal, plunged in a state of white heat into mercury. The theory is that in a homogeneous conductor the compressions and dilatations of the molecules balance each other, and no variation of current ensues, while under minute sub-division, with electrical continuity, sonorous waves affect the strength of an electric current, and variations in the current reproduce sonorous waves. One form of microphone consists of a piece of mercury-tempered carbon an inch long, placed vertically between two carbon-blocks hollowed to receive its ends, wires connecting the blocks with the battery and the receiver by which the sounds are to be heard. “A piece of willow-charcoal,” says the inventor, “the size of a pin’s head is sufficient to reproduce articulate speech.” Two nails laid parallel, with wire connections, and a third nail laid across them, make a simple form of microphone. A few cells of any form of battery may be used. A continuous sound is made by the mutual interaction of the microphone and tele-

phone, each instrument in turn repeating the sound made by the other. Many useful applications of the microphone have been made.

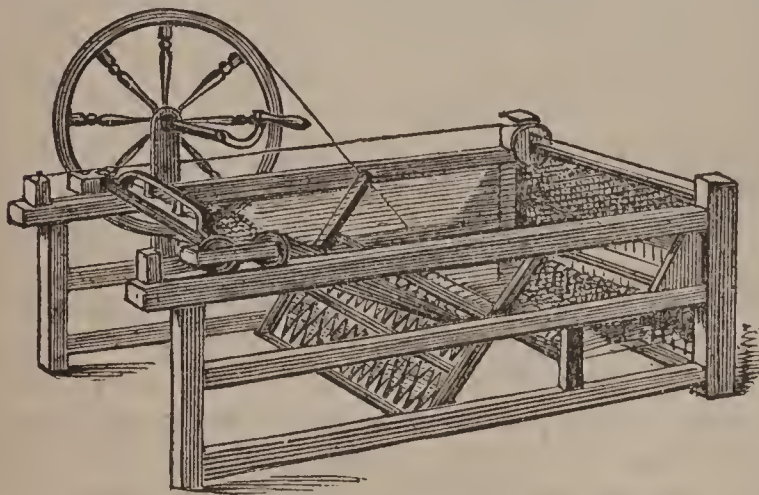
The Cotton Gin.—Eli Whitney, the inventor of the cotton gin, was born at Westborough, Massachusetts, December 8, 1765, and was educated at Yale College, where he paid his expenses partly by school teaching, partly by mechanical labor. Having graduated in 1792, he went to Georgia as a teacher; but finding a generous patron in the widow of General Greene, of the revolutionary army, he resided upon her estate and studied law. The cotton culture at this period, especially that of the best kind, the "green seed," was limited by the slow and difficult work of separating the cotton from the seed by hand; but Mrs. Greene told her complaining neighbors that she was sure Whitney could help them out of their trouble, for he could make anything. At their desire, he set to work under great disadvantages, for he had to make his own tools, and even draw his own wire; but the reports of his success prompted some lawless people to break into his workshop and steal his machine and get others made before he could secure a patent. He, however, formed a partnership with a Mr. Miller, in 1793, and went to Connecticut to manufacture cotton gins; but the lawsuits in defense of his rights took all his profits, likewise \$50,000 voted him by the State of South Carolina. He afterward amassed a fortune in the manufacture of firearms, but received but barren honor from the gin, one of the most important of the whole series of inventions connected with the cotton manufacture. The machine invented by Mr. Whitney is composed of a hopper, having one side formed of strong parallel wires placed so close together as to exclude the passage of the seeds from within. The cotton is dragged through the apertures by means of circular saws attached to a large roller, and made to revolve between the wires, the seeds sinking to the bottom of the hopper.

The Spinning Jenny.—The modern system of cotton manufacture dates no further back than about 1760. Prior to the mechanical inventions of Hargreaves, Arkwright, Crompton and Cartwright, the arts of spinning and weaving were entirely domestic, and the instruments of manipulation much the same as those which had been in use in the East for centuries before. By means of the ancient distaff and spindle, or the more recent spinning-wheel, only *one* thread at a time was produced, and the process, as may be imagined, was tedious, and not very remunerative; besides which, only a very inferior yarn was the result. Altogether in the middle of the eighteenth century the machinery for spinning was much more imperfect than that for weaving, and the weavers of the time were often at a stand for want of yarn to go on with.

This state of things had long occupied the attention of the thinking portion of the spinners, but without any practical result until the invention of the "jenny," by Hargreaves, about 1767. By this machine, eight threads at a time could be spun against the one of the spinning-wheel. Hargreaves was much abused by the populace of his native town and neighborhood, who feared that the invention would deprive them of all employment; the machine was destroyed, and the inventor compelled to leave his birthplace. Genius, however, ultimately triumphed, and the "spinning jenny" was patented at Nottingham in 1770. The year previously, Arkwright had patented his "water-frame," or "throstle," for spinning by rollers, by means of which a stronger and much firmer yarn was produced. It was about this period that fabrics composed entirely of cotton were woven for the first

time, the "jenny" supplying the *weft*, and the "throstle" the *warp*. A few years later, Mr. Crompton brought out a new piece of mechanism, which he styled the "mule jenny," from its combining the principles of both Hargreaves' and Arkwright's patents; but it had an advantage over both, inasmuch as it produced a much finer yarn than either. The "mule" came into full play in or about 1780, which is the period assigned for the birth of the *muslin* trade. There was now no longer a scarcity of yarn; the fear was that there would be too much, for it was clear that the hand-loom weavers of the time could not keep up with the improved spinning machinery. But the invention of the "power loom," by Dr. Cartwright, in 1785, set aside all doubts in this respect.

The first "mule jenny" contained about *thirty* spindles, which, instead of being stationary, as in the "jenny" and "throstle," were placed on a carriage, which was moved outwards in order, while twisting, to increase the fineness of the thread, and inwards again to wind the yarn on the spindles. This required the constant attendance of a spinner to wheel the carriage backwards and forwards; but subsequent improvements have gone so



THE SPINNING JENNY.

far as to produce what is called the self-acting mule, two or three of which only require the assistance of one person, generally a boy or girl, whose place it is to piece any of the threads which may break during spinning. Mules of this construction are made with as many as one thousand or two thousand spindles, sometimes more; and with

the self-actor, as now improved, a single thread has been produced measuring upwards of *one thousand miles in length*, and yet weighing but *one pound*.

The Type-Setting Machine.—The first type-composing machine on the records of the English Patent Office appears to be that of Mr. W. Church, and the specification of his patent is dated March, 1822. This, after a lapse of twenty years, was followed by a number of others, scarcely a year passing without one or more being made the subject of a patent. For at least half a century, therefore, the construction of a useful type-setting machine has been a problem which a number of ingenious men have tried to solve, but it is only within the last year or two that there has been anything more than the mere appearance of success. If the reader will look carefully at a page of printed matter, he will notice that the spaces between the words are not equal, and he will readily understand that to reduce this inequality to a minimum, requires skill and experience if the work is to go on swiftly. It is in the doing of this, which is called "justifying," where a machine fails, because another operator must afterward space the machine setting into lines of equal length. It is comparatively easy to construct a machine which will, by some mechanical arrangement, drop any required

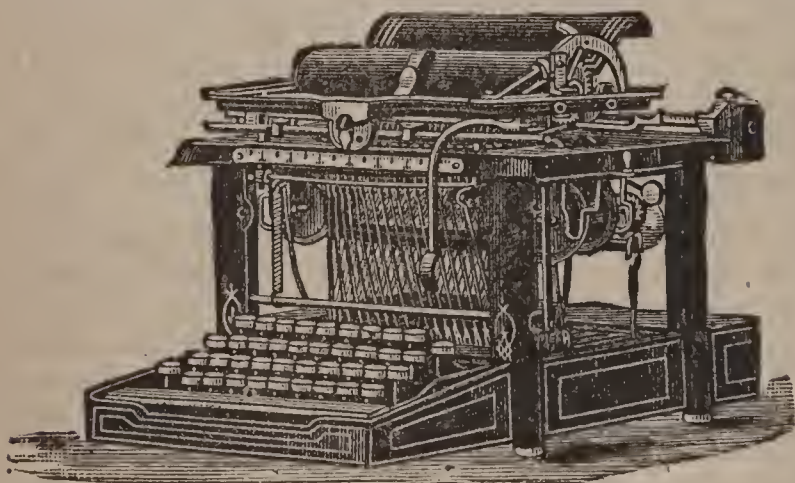
letter from a series of files or reservoirs of types, through a channel which conveys to a composing stick—that is, which will set up type in any required order, but with *exactly equal spaces* between the words; but the difficulty of justifying has not yet been got over. Still, as that operation can be performed by girls at comparatively little cost, there is a decided advantage in favor of the machine.

In the early composing-machine by Church, the types are arranged, in files in a case at the top, each file being directly over a slit in a horizontal frame. One of a number of jacks protrudes through each of these slits, each jack being connected with a key in a manner somewhat similar to the jacks and keys of a harpsichord. On the depressing of any particular key, the undermost type of the file is pushed into a race, from which it passes to a composing stick. It is surprising how closely this description conveys to us the leading idea in most of the type-composing machines invented since 1822. Hattersley's machine, for example, which was patented in 1857, has somewhat analogous movements, but the keys are arranged more like those of a *concertina*, and the details are different. This machine, which occupies a space of about two feet by three, has a horizontal top stage on which is placed a partitioned tray, containing the rows of types running from back to front, each row being of course all the same letter. Descending vertically along the front of this tray is a series of as many wires with pistons as there are rows of types, and these pistons are depressed by the keys acting by bell-cranks, and then returned to their first position by means of india-rubber bands or springs. A propeller kept in a state of tension by an india-rubber spring is placed in the rear of each row of types, and draws them forward to the piston. When the girl working the machine presses down, say an *e* key, it depresses the *e* piston, which pulls down with it an *e* type, and drops it into a tube or channel which conveys it to what represents the composing stick, and so on with every other letter, figure, comma, or "space." The series of channels converge to a focus or common outlet, through which every type in succession passes to its proper place. Machines on Hattersley's principle, with the details much improved by Mr. Fraser, of Edinburgh, are at present in use. With one of these machines a girl can compose from "copy" at the rate of from ten thousand to twelve thousand types per hour, but this rate can hardly be maintained continuously, the strain of such rapid setting being too great for the operator. The types are set in long lines, and require afterwards to be "justified." This is done by another girl, who, with the aid of a slip of brass of the desired length of the line, forms the matter into pages, spacing out each line as she proceeds.

The want of an efficient distributing machine has hitherto been the great drawback to the adoption of composers, but Mr. Fraser has met this difficulty by constructing a distributor which bids fair to supply the want. It separates the different letters by a series of switches acted upon by keys similar to those of the composing machine. On the depression of a key, the corresponding switch is opened, and the type guided to its proper compartment in the composing-machine reservoir. Type-setting and distributing machines like the above in their plan of working have been in operation for several years. Another composing machine, by Mr. Mackie, of Warrington, England, deserves notice for the ingenuity shown in its construction. It is much more elaborate than any of those above referred to. The first operation is to perforate slips of stiff paper, which is done by a separate machine. These slips, when perforated, represent the words to be composed, and are then passed to the composing-machine proper. In it the

types are placed by hand in a series of boxes above the circumference of a large wheel, which is made to revolve, and at each revolution a certain part, acting in concert with the previously perforated paper, comes in contact with mechanism which releases the desired types at the proper time, and carries them forward to a point, where they are pushed off into lines in the composing stick.

The Type-Writer.—The writing machine called the Type-Writer was invented at Milwaukee, Wisconsin, in 1867, by C. Latham Sholes, Samuel W. Soule and Carlos Glidden, and patented in 1868. Mr. Glidden's suggestion that such a machine ought to be made was his principal contribution to the enterprise. It was Mr. Soule who suggested pivoted types set in a circle, and Mr. Sholes who suggested the letter-spacing device. The other minor details of the first crude machine were the work of Mr. Soule. The labor spent in experimenting extended over a period of nearly ten years, during which many machines were made and condemned, although each was an improvement upon its predecessor. But when at length the first complete



THE TYPE-WRITER.

and finished type-writer was made and offered to the public by Messrs. E. Remington & Sons, of Ilion, New York, to whom its manufacture had been entrusted, it was recognized at once as one of the great inventions of modern times. The types are at the end of levers, so arranged as to strike at a common

printing point, the operator having but to depress keys, arranged with reference to rapidity of motion in the necessary order. The paper is passed along by a species of clock-work machinery. An expert operator can write with this machine more than twice as fast as with the pen. It is in much favor with business men, who, by employing an operator likewise familiar with stenography, may in a few moments dictate a mass of correspondence which would otherwise perhaps consume a day's time in execution. It is likewise of inestimable service to lawyers and others, for by the use of carbon paper, several copies of any writing or instrument executed upon the type-writer may be taken. The Standard Type-Writer is still manufactured under the original patents by Messrs. E. Remington & Sons, and sold exclusively by the firm of Wyckoff, Seamans & Benedict, of New York, who are sole agents for the world.

The Mower and Reaper.—In the first century of the Christian era Pliny the elder found a reaping machine in Gaul. He described it as a van, with projecting teeth on the edge, which was driven upon two wheels through the standing grain by an ox yoked in a reverse position. This rude affair tore off the ears, abandoning the straw. Four centuries later Palladius found a similar appliance for reaping grain in Gaul,

In modern times the idea of a mechanical reaper appears to have originated with a Mr. Capel Lloft, an Englishman, who, in 1785, suggested a machine very little superior to the rude appliance above described. In the early part of the present century numerous patents were granted in Great Britain for mechanical reapers, and the Rev. Patrick Bell, a Scotchman, in 1826, constructed a simple machine, several features of which are observable in the reapers of the present day. All of these machines, however, were more or less crude and experimental, and the real credit for the invention of the mower and reaper is due to two Americans, Hussey and McCormick.

In 1833 Obed Hussey invented the reciprocating wave-edged knife, and his machine, having been tried in the State of Ohio, was patented the same year. In 1834, C. M. McCormick, a Virginian, patented a reaper which comprised many improvements, but in which Mr. Hussey's knife was adopted. In the early days of the reaper the sheaves were delivered directly in the rear of the machine, whereby a sufficient number of men were required in the harvest field to bind the grain as fast as cut. Subsequently the platform of the machine was made of a quadrant shape, the sheaves being delivered at the side. The delivery of the sheaves by manual labor was early abandoned, and many improvements in the self-raking attachments were invented and patented. In recent years the entire attention of the manufacturers of patented harvesters has been devoted to the invention of an attachment for binding the grain as it is cut. Some of these binders use wire, others cord, the latter being preferred.

The Sand Blast.—Among the wonderful and useful inventions of the times is the common sand blast. Suppose you desire to letter a piece of marble for a gravestone; you cover the stone with a sheet of wax no thicker than a wafer, then cut in the wax the name, date, etc., leaving the marble exposed. Now pass it under the blast and the wax will not be injured at all, but the sand will cut the letters deep into the stone. Or, if you desire raised letters, a flower or other emblem, cut the letters, flowers, etc., in the wax, and stick them upon the stone; then pass the stone under the blast and the sand will cut it away. Remove the wax and you will have the letters raised. Take a piece of French plate glass, say two feet by six, and cover it with fine lace; pass it under the blast and not a thread of the lace will be injured, but the sand will cut deep into the glass wherever it is not covered with lace. Now remove the lace and you have a very delicate and beautiful figure raised upon the glass. In this way beautiful figures of all kinds are cut in glass, and at a little expense. The workmen can hold their hands under the blast without harm, even when it is rapidly cutting away the hardest glass, iron, or stone, but they must look out for their finger nails, for they will be whittled off right hastily. If they put on steel thimbles to protect the nails, it will do little good, for the sand will soon whittle them away, but if they wrap a piece of soft cotton around them they are safe. You will at once see the philosophy of it. The sand whittles away and destroys any hard substance, even glass, but does not affect substances that are soft and yielding, like wax, cotton, or fine lace, or even the human hand.

Accidental Discoveries.—Valuable discoveries have been made and valuable inventions suggested by the veriest accidents. An alchemist, while seeking to discover a mixture of earths that would make the most durable crucibles, one day found that he had made porcelain.

The power of lenses, as applied to the telescope, was discovered by a watch-maker's apprentice. While holding spectacle glasses between his thumb and his finger he was startled at the sudden enlarged appearance of a neighboring church spire.

The art of etching upon glass was discovered by a Nuremberg glasscutter. By accident a few drops of aqua fortis fell upon his spectacles. He noticed that the glass corroded and softened where the acid had touched it. That was hint enough. He drew figures upon the glass with varnish, applied the corroding fluid, then cut away the glass around the drawing. When the varnish was removed the figure appeared raised upon a dark ground.

Mezzotinto owed its invention to the simple accident of the gun-barrel of a sentry becoming rusty with dew. The swaying of a chandelier in a cathedral suggested to Galileo the application of a pendulum.

The art of lithographing was perfected through a suggestion made by accident. A poor musician was curious to know whether music could not be etched upon stone as well as upon copper. After he had prepared his slab his mother asked him to make a memorandum of such clothes as he proposed to be sent away to be washed. Not having pen, ink and paper convenient, he wrote the list on the stone, intending to make a copy at his leisure. A few days later, when about to clean the stone, he wondered what effect aqua fortis would have upon it. He applied the acid, and in a few minutes saw the writing standing out in full relief. The next step was simply to ink the stone and take off an impression. Hence the lithograph.

It is said that the rolling of cold iron was first suggested by the fact that a workman who was placing a piece of hot iron in the rolls carelessly permitted his tongs to be drawn in. He noticed that they were rolled, and not broken. He called the attention of the superintendent to the occurrence, and this led to investigation and experiment and the discovery that cold rolled iron is equal to steel for shafting purposes. The process of rolling iron cold was not long afterward patented, and millions of dollars have been made out of the patent.

There are many similar instances where observing workmen have called attention to valuable processes. A signal one was in the early period of the cotton manufacture, when a good deal of trouble was caused by the cotton sticking to the bobbins. All the workmen in the mill were delayed by the necessity of stopping work to clean the bobbins. At last one workman found a way to obviate the trouble. He, and he alone in all the mill, had clean bobbins. For a long time he kept his secret to himself. He finally revealed it on the promise of a pint of beer a day for life. His secret was to "chalk the bobbins." That little scraping of salt on the bobbins saved millions of dollars a year, and the observing workman got not only his beer, but a competence.

The Age of Inventions.—The number of inventions that have been made during the past fifty years is perhaps unprecedented in the history of the world. Of course inventions of benefit to the human race have been made in all ages since man was created; but looking back for half a hundred years, how many more are crowded into the past fifty than into any other fifty since recorded history! The perfection of the locomotive, and the now world traversing steamship, the telegraph, the telephone, the audiophone, the sewing machine, the photograph, chromo-lithographic printing, the cylinder printing press, the elevator for hotels and other many storied

buildings, the cotton gin and the spinning jenny, the reaper and mower, the steam thresher, the steam fire engine, the improved process for making steel, the application of chloroform and ether to destroy sensibility in painful surgery cases, and so on through a long catalogue.

Nor are we yet done in the field of invention and discovery. The application of coal gas and petroleum to heating and cooking operations is only trembling on the verge of successful experiment, the introduction of the steam from a great central reservoir to general use for heating and cooking is foreshadowed as among the coming events, the artificial production of butter has already created consternation among dairymen, the navigation of the air by some device akin to our present balloon would also seem to be prefigured, and the propulsion of machinery by electricity is even now clearly indicated by the march of experiment. There are some problems we have hitherto deemed impossible, but are the mysteries of even the most improbable of them more subtle to the grasp than that of the ocean cable or that of the photograph or the telephone? We talk by cable with an ocean rolling between; we speak in our own voices to friends one hundred miles or more from where we articulate before the microphone.

Under the blazing sun of July we produce ice by chemical means, rivaling the most solid and crystalline production of nature. Our surgeons graft the skin from one person's arm to the face of another, and it adheres and becomes an integral portion of his body. We make a mile of white printing paper, and send it on a spool that a perfecting printing press unwinds and prints, and cuts, and delivers to you folded and counted, many thousands per hour. Of a verity this is the age of invention, nor has the world reached a stopping-place yet.

Coincidences in Inventions.—Coincidences in invention and discovery are the rule rather than the exception. When any notable advance is made in the knowledge of the laws of nature, or in applying that knowledge, old or new, to the service of man, it is hardly ever one person alone who makes the discovery or the application. Almost always more than one claimant appears, and frequently several make good their claims to the honor of having pursued independently and to valuable results the same line of thought or experiment that has made one of their number famous by associating his name permanently with the great invention or discovery. Le Verrier and Adams almost simultaneously reasoned out the existence of the planet Neptune, and directed astronomical observers how to point their telescopes in order to find it. Professor Morse's title to distinction as the inventor of the magnetic telegraph was stubbornly contested by men who had labored with the same idea before it occurred to him. Half a dozen others had toiled upon the problem of steam navigation before Fulton solved it. Morton, Jackson, and Wells were experimenting with anæsthetics at the same time, and the merit of the discovery is still claimed for each of them. Bell and Gray invented their respective telephones almost at the same time. Edison and Hughes dispute each other's claim to priority in the invention of the microphone. In some of these cases probably one claimant has knowingly or unconsciously borrowed something from his rival; but those where two or more persons have pursued independently substantially the same line of research and experiment, tending to the same result, are very numerous.

MINING.

Gold.—Gold has been known and regarded as the most precious of the metals from the earliest ages of the world, and has been universally employed as a medium of exchange. Although the quantity of gold which is found, when compared with that of many other metals, is small, yet there are few parts of the globe in which it does not occur more or less abundantly. In the native state, it occurs crystallized, the primary form being the cube, or in plates, ramifications, or nodules—popularly known as *nuggets*—which sometimes are of very considerable size. It is almost always alloyed with silver, and sometimes with tellurium, bismuth, lead, etc. It sometimes occurs in small quantity in metallic sulphides, as in galena, iron and copper pyrites.

In its compact state, it possesses a characteristic yellow color and high metallic lustre, is nearly as soft as lead, and is the most malleable of all metals. It can be beaten into leaves of a thinness not exceeding 1-200,000, or, according to some authors, 1-280,000 of an inch, through which light passes with a green tint; one grain may thus be distributed over fifty-six square inches of surface, and the ductility of the metal is so great, that the same quantity may be drawn out into five hundred feet of wire.

Gold was, in all probability, one of the earliest discovered of the metals. The fact of its being found very generally distributed over the surface of the earth, and that, too, in its simple metallic state, combined with its beautiful color, and many valuable properties, would cause it very early to attract the attention of man. Accordingly we learn that gold was used by the Hebrews, the Egyptians, and other ancient nations, for much the same purposes as it is at the present day.

Previous to the great Californian discovery in 1847, Europe was to a great extent supplied with gold from Mexico, Brazil, New Granada, Chili and Peru in North and South America; a large quantity was also obtained from Asiatic Russia and the islands of the Indian Archipelago; the east and west coast of Africa furnished a less but still considerable quantity. All these countries still produce gold, but their total yield, including Europe, is only about one-fourth that of California and Australia.

The rich gold region of California was discovered in September, 1847. Mr. Marshall, the contractor for a saw-mill on the estate of Captain Suter—a Swiss emigrant, settled on the banks of the Sacramento River—detected particles of gold in the sand of the mill-race, and on further examination, it was found that valuable deposits existed throughout the bed of the stream. Intelligence of the discovery soon reached the town of San Francisco, whose scanty population at once abandoned their usual occupations to join in the exciting search for gold. The supply was soon found to be abundant over a large area, and emigrants quickly poured in from all parts of the American continent, and ere long from Great Britain, Germany, and other European countries, till the population of San Francisco alone rose from under two hundred in 1845 to forty thousand in 1853, and in 1870 it was one hundred

and fifty thousand. At first it was thought that the supply of gold from this region would soon fail, but though the supply, which continued for several years at upwards of \$85,000,000 per annum, had in 1874 fallen to between six and seven millions, which, moreover, included the yield of the adjoining States of Oregon, Idaho, Montana and Wyoming, future mining prospects are far from being discouraging.

In 1851, before the excitement of the Californian discovery had time to subside, the world was startled by the announcement of another, or rather by a series of others, of not less importance, in Australia. It is a curious fact that not only Sir R. Murchison, but also the Rev. W. B. Clarke, a native geologist, had pointed out the likelihood of gold being found in the eastern chain of the Australian mountains several years before the value of the gold fields near Bathurst was discovered by Mr. Hargraves in April, 1851. This discovery was no sooner made, however, than several other places in Bathurst and the adjoining counties were found to contain rich deposits; so that, before many months had passed, six thousand persons were employed at these *diggings*. In August of the same year, further discoveries of gold were made at Ballarat, in Victoria, which excelled in richness those of the Sydney district; and these, in turn, were soon surpassed by fresh discoveries in the Mount Alexander range. During the climax of the excitement created by the Victoria gold fields, the number of diggers rose to such a pitch as to withdraw for a time the great mass of the population from Melbourne and Geelong.

The modes of working adopted at the first start of the diggings were necessarily rude and wasteful; the fortunes of the gold seekers, too, were of course very variable under such a system, many of them having made large profits—as much in a few instances as five thousand dollars and upwards in a single week—but many more met with nothing but disappointment. A more systematic plan of mining, however, has now been introduced, by which the auriferous deposits are more completely worked out, and mining undertakings rendered less precarious. But notwithstanding the improved methods of working, the average annual produce of gold in the Australian colonies for the five years ending 1874, was only about \$35,000,000, which was less than two-thirds of the yields of some earlier years. In the London International Exhibition of 1862 there was a gilded pyramid ten feet square at the base and forty-five feet high, representing the mass of gold exported from Victoria between the 1st of October, 1851, and the 1st of October, 1861. Its weight in solid gold would have been 26,162,432 ounces troy, which, taken roundly at \$20 per ounce, gives its value as \$523,248,640. The produce of California since the discovery of its gold fields in 1847, up to the present time, may be estimated at about 50,000,000 ounces, and its value at \$1,000,000,000.

Since the two great gold regions of California and Australia became known, three new ones of considerable promise have been discovered—one of them in British Columbia, the value of which was proved in 1858, although previously it was to some extent known to the Hudson's Bay Company; another is being successfully developed in Nova Scotia; and a third in the province of Otago, New Zealand. It would appear that there is a great similarity between the general rock systems and auriferous deposits of this region and those of Australia. Before passing from the subject of recent gold fields, it is worth noting that a few years ago, Dr. Livingstone, the African traveler, discovered gold near Tete on the Zambesi—a district which may be found to be rich in the precious metal, when more de-

liberately surveyed. Its position is remarkable as occurring in the center of a coal field.

The annual produce of gold in the whole world at the present time is somewhere between one hundred and fifty and two hundred millions of dollars. Wherever gold is found, its origin can generally be traced to quartz veins in the primary or volcanic rocks, such as granite, gneiss, porphyry, clay-slate, or greenstone. As these rocks became decomposed by the action of the weather, portions of the auriferous veins were carried down by streams and floods, and so found their way into the deposits of sand, clay and shingle in river beds, and in the gullies and flats of hills. Many auriferous drifts are of great thickness, formed by long-continued wasting of the rocks of neighboring hills, and therefore require mining to a considerable depth. Gold for the most part is found in small grains, or scales, called gold dust; some of it, however, in pieces, or *nuggets* of considerable size. One found at Ballarat in 1858, called "The Welcome," weighed 2,166 ounces, and its value was about \$40,000. Another discovered in Donolly District, Australia, in 1869, weighed 2,520 ounces, and its value was about \$45,000. A good deal of the Mexican and European gold is obtained from auriferous pyrites.

Nearly all the metals except gold are most usually found as ores chemically combined with oxygen, sulphur, or other substances; and they therefore require to be separated by chemical processes. Gold ores, if we may use the term, require to be mechanically treated by the processes of crushing, stamping and washing; the amalgamation process being resorted to when the gold occurs in a state of fine division.

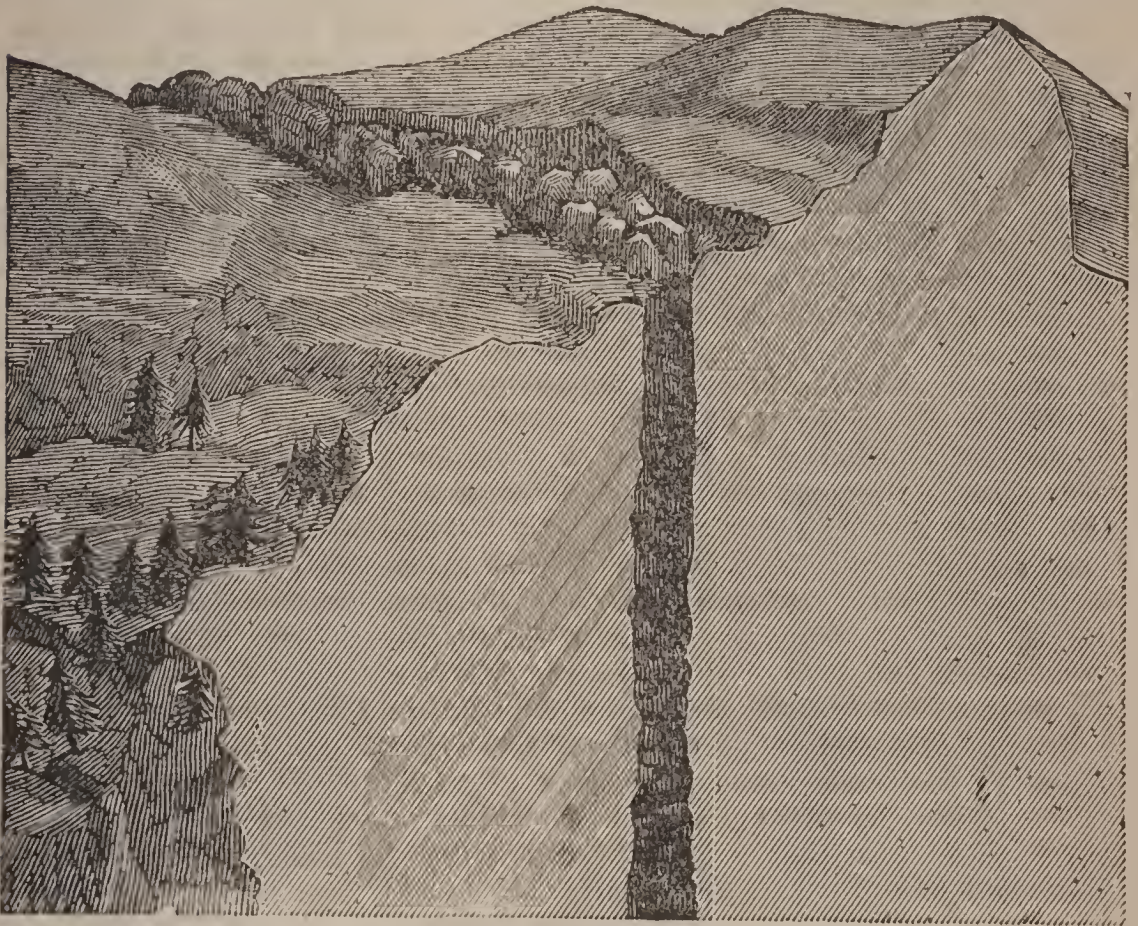
One kind of crushing mill consists of two large cast-iron rollers, which break the auriferous quartz into small pieces as it passes through between them. More usually now, a stamping mill is used with iron-shod piles of wood, wrought by an axle with projecting cams, after the fashion of flint mills and beetling machines. The ore pounded by the stamps is next washed, and for doing this there is an almost endless number of contrivances. In one of the richest quartz districts of California, it is carried by a current of water over coarse woollen blankets laid on slooping boards. By this plan, the lighter particles of quartz are carried away, and the particles of gold become entangled in the fibres of the wool. The blankets are washed at intervals in a tank, where the gold and other matters caught on their surface accumulates. It is then ready for the amalgamation process.

The gold of auriferous drift is partly extracted by washing, but there still remain minute particles invisible to the naked eye mixed with the *gangue*; indeed, some auriferous soils contain all their gold in a state of extreme division. To recover the gold either from this or stamped quartz, an amalgam is made; that is, it is mixed with mercury, which has the power of seizing on and dissolving the gold particles, however minute. The mercury is afterwards distilled off in a retort, leaving the gold nearly pure. Gold has of late been profitably extracted from sulphuretted ores by Plattner's process, which converts it into a liquid chloride, and the gold is then precipitated from the solution by metallic copper.

Silver.—Silver is a metal which, in its compact state, is of a brilliant white color, possesses the metallic lustre to a remarkable degree, is capable of being highly polished, and evolves a clear ringing sound when struck. It is harder than gold, but softer than copper, and is one of the most ductile of the metals. It is malleable, may be hammered into very thin leaves, and

may be drawn out into very fine wire, the thinnest silver leaf having a thickness of only 1-100,000th of an inch, and one grain of the metal being capable of yielding four hundred feet of wire. It possesses a high degree of tenacity, a wire with a diameter of 1-12th of an inch being able to support a weight of nearly one hundred and eighty-eight pounds. It requires a heat of 1873° Fahrenheit to fuse it, and on cooling, expands at the moment of solidification. It is an excellent conductor of heat and electricity, and is not affected by exposure even to a moist atmosphere at any temperature.

Silver, like gold, has been known and prized from the earliest ages. The silver mines of Mexico were, until quite recently, by far the richest known to exist. Their estimated annual yield is about 1,600,000 pounds troy of the pure metal. Until the remarkable discoveries of silver ore in Nevada and



A SILVER MINE.

adjoining States and Territories in 1859 and 1860, Chili and Peru had long stood next to Mexico in their yield, each furnishing about one-sixth of the produce of that country. Bolivia is also rich in silver; but the recent extraordinary development of silver mining in the Western regions of the United States, appears to have raised their produce to at least a par with that of Mexico, so that these two countries now furnish three-fourths of all the silver obtained in the world. Of European countries, Spain is the most productive, the richest mines being those of Huelga de la Encina, in the province of Guadalupe, which were first extensively opened in 1846. These have yielded immense wealth, but their produce has much declined since 1858. Silver glance is the principal ore, although several others are found, including quantities of the formerly rare mineral freieslebenite, which contains

about 23 per cent. of silver. Next to Spain, Austria, Saxony and the Harz district in Northern Germany yield the largest supplies. The silver mines of Kongsberg, in Norway, are likewise valuable, and have been long famous.

As previously stated, the great natural deposits of silver in the Rocky Mountain region were not discovered until the years 1859 and 1860. Prospectors and pioneers traversing Arizona, Idaho, Nevada, Colorado, and other Territories in the far West in search of gold, by mere accident discovered the greatest silver mine ever known. The celebrated Comstock lode in Storey County, Nevada, twenty miles from Reno, on the Union Pacific Railroad, was found in 1859 by James Shinney and Henry Comstock. So little did these men understand the value of their discovery that they parted with their interest for a mere trifle. A company was formed, and work was commenced in 1861. By 1865 the mine had yielded to the value of \$30,000,000, and Virginia City, with a population of 20,000, had sprung up in the locality, and was flourishing in a manner truly remarkable. In 1876 the mines of the Comstock lode yielded silver ore to the value of \$36,500,000. Such an unparalleled result naturally produced a "silver fever," and extensive prospecting at once began in various parts of Colorado, Idaho and Montana. The mines of Leadville were not discovered until 1877, but shortly after yielded \$16,000,000 in a single year.

The forms in which silver is found in nature are numerous, but we need only notice a few of them. It is frequently found native in crystallized and amorphous masses, which are sometimes of considerable size. But the quantity of silver found in nature in the metallic state is comparatively small. Its principal ores are the different sulphides or sulphurets—viz., silver glance, or sulphuret of silver, containing when pure, eighty-seven parts of silver and thirteen of sulphur; brittle silver ore, or sulphuret of silver and antimony, of which the composition is, silver 68·5, antimony 14·7, and sulphur 16·4; and red silver ore, called also ruby silver, of which there is a dark and a light kind, the composition of the former being similar to brittle silver ore, but it is a little less rich in silver, and the latter only differs in containing arsenic instead of antimony. The bulk of the silver obtained in Mexico and South America is got from these ores. The only other of much importance, except the mixed ores, is horn silver, or chloride of silver. In a pure state, it consists of silver seventy-five, and chlorine twenty-five. It occurs extensively in Mexico and Peru. Besides the ores named above, a good deal of the silver of commerce is obtained from mixed ores, that is, the ores of other metals are frequently found to contain it. In many cases, the amount of silver falls greatly short of one per cent. These ores are for the most part sulphurets of lead, arsenic, copper, zinc and iron.

The reduction of silver ore is a heavy manufacturing business, requiring extensive and complicated machinery and appliances, and rather more than the usual proportion of skilled labor. Step with me, if you care to see an illustration, into a complete mill, and watch the ore turn, in due process, to bars of bullion.

Outside is a small hill of ore, transported by wagon, at a cost of from four to six dollars a ton, from the mines ten miles distant. The ore is simply a hard quartz, infiltrated with various metals. Unless the ore is very rich you can seldom discover, even by the aid of a glass, any of the minute particles of silver. Some ore looks like gray limestone. The Pahr-anagat ore is almost prismatic, being spotted yellow by decomposed lead,

blue by copper, brownish red by iron, and dark lead color or black by silver. The ore is carried in ox-hide baskets to the crushing-room, where it is weighed and registered. Then it is poured out in the stamp-room, where a man with a long-handled shovel feeds it under the stamps.

The ten stamps are simply upright iron hammers, weighing six hundred and fifty pounds each. Their province is to crush the ore into a dust as fine as flour. The dust cannot escape from the stamps until it flies through sieves in powder so minute as to be almost impalpable to the touch. A ton of ore can be sufficiently crushed in two and one-third hours.

The next step is to roast your fine powder (or pulp, as it is called) in order to burn up all the base metals in it except silver, gold and copper. The "roasters" are ordinary ovens, like those used for baking bread, except that the flues are admitted to the chamber where the pulverized ore is deposited. Workmen called "roasters" also stir the dust with long-handled shovels, keeping up a cherry red heat. Each of the five furnaces has a capacity for half a ton of dust, and the time consumed in roasting the pulp is six hours. Your dust, when thoroughly roasted, contains nothing but gold, silver and copper in powdered quartz. The other metals have been effected by fire and large quantities of salt thrown in to chlorodize them.

The roasted dust is raked out on the opposite side of the furnace and conveyed into the amalgamating pans, or large tubs filled with hot water, where it is further ground in a sort of iron fan-wheel, and where five pounds of quicksilver are thrown in for every pound of silver you estimate the ore to contain. The union made, the amalgam of the two metals sinks to the bottom of the tub, and the quartz powder runs off in a muddy rill from an orifice above.

Next, the amalgam is taken from the bottom of the tubs and strained through canvas bags, in order to get rid of any superfluous quicksilver. The amalgam, after this straining, is five parts quicksilver, and one part silver. It looks and feels like a silvery sort of wet, white sand. The amalgam is now ready for the "amalgamator," the most important artisan about the mill, and the one who generally has charge of both mill and workmen. He places the amalgam in a face of his own, and builds a fire hot enough to send the quicksilver off in a vapor, leaving a residuum of silver. The flying vapor is condensed in water and returned to its original form of quicksilver, ready to be used again, having lost but one per cent. of its bulk. The silver left in the retort looks like rusty chips of ragged metal, and is anything but precious in appearance.

The process of casting the silver bar (its usual weight is about eighty-five pounds) is simple enough. The silver chips are placed in a black lead mold, melted, and come out in a bar of silver, or rather, a bar about eight hundred parts silver and two hundred parts copper. Such is the bullion of commerce. and such a bar is worth from \$1,200 to \$1,300 in coin. The copper is taken out in the mints in such a manner as to save it.

A good silver mill, with its branch buildings, covers two acres, and is crowded in all parts with machinery. The milling process, at best, does not save over eighty-five per cent. of the silver in the ore. The other fifteen per cent. is sensibly lost in the various stages of reduction. A ten-stamp mill burns twelve cords of wood per day, and consumes one thousand five hundred pounds of salt. Other supplies and labor run up its daily expense to \$500. If it has \$100 ore, its receipts are \$100. But \$100 ore is a high grade and not very abundant in any mines in Nevada, so far as they have been penetrated by the pick.

Diamonds.—The most valuable of all precious stones with the exception of the ruby, and the hardest of all known substances, is the diamond. It consists of carbon, a simple or elementary substance, crystallized, and in its greatest purity. Diamonds are commonly colorless and as clear as water; although, sometimes from some slight foreign intermixture, they are white, gray, yellow, green, brown, and more rarely orange, red, blue or black. The lustre is adamantine and very high, and it becomes positively electric by friction. Its hardness renders it incapable of being scratched by any other substance, and in cutting and polishing diamonds diamond dust is employed. The estimation in which it is held as a precious stone is due to its remarkable hardness, rarity and brilliancy. The art of cutting diamonds, although long practiced in India and China, was not known in



DIAMOND MINING IN AFRICA.

Europe till after the middle of the fifteenth century, when it was discovered by Louis van Berguen of Bruges. Previous to that time, diamonds were set without being cut, and in that state they have often a rough, dull and uneven surface. Diamonds are indeed found not only in the form of perfect crystals, but also in rolled grains; and they are obtained partly from alluvial soils and the sands of rivers, and partly from rocks, chiefly a quartzzy sandstone or conglomerate, in which they are often associated with gold. A number of localities in India have long been celebrated as productive of diamonds, particularly Golconda; they are found also in Malacca, Borneo, and other parts of the East; nor were any diamonds procured in any other part of the world till the beginning of the eighteenth century, when they were discovered in remarkable abundance in the district of Serra do Frio, in the province of Minas Geraes, in Brazil. Previous to that time, diamonds

found in Brazilian gold mines had been disregarded as mere pebbles; their nature became known in consequence of some of them accidentally finding their way to Europe. In 1829, they were discovered in the Ural Mountains. They have also been found in Rutherford County, North Carolina; in Hale County, Georgia; in the province of Constantine, Algeria; in Australia; and in South Africa. Diamond mines consist in general of mere diggings and washings of alluvial deposits. In Brazil, the method pursued is to rake the alluvial matter backwards and forwards on inclined planes, over which a stream of water is made to run, till the lighter particles are carried away, when large stones are picked out by the hand, and what remains is carefully examined for diamonds. The work is carried on by slaves, and when a diamond of seventeen carats is found, the slave who finds it is entitled to his liberty. Large diamonds are comparatively rare among those of Brazil, all the notable diamonds in the world being Indian. Brazil produces yearly from twenty-five thousand to thirty thousand carats of diamonds, of which, however, not more than nine thousand carats are capable of being cut, the rest being either very small or of inferior quality. The small and inferior diamonds are called *bort*, and command a ready sale for their use in the arts, being pounded in a steel mortar, and much employed in the form of diamond-dust by lapidaries for cutting and polishing diamonds and all kinds of gems, and even for polishing rock-crystals for spectacles. Minute fragments or splinters of bort are also used for making fine drills, which are used for drilling small holes in rubies and other hard stones to be employed in watch-making, gold and silver wire-drawing, etc., and for piercing holes for rivets in china, in artificial enamel teeth, etc. The use of small diamonds by glaziers for cutting glass is well known. The diamonds so used are uncut, and they are so mounted as to act upon the glass not by an angle, but by a curvilinear edge of the crystal. The cut is only to the depth of about one two-hundredth part of an inch, but is sufficient to make the glass readily break in accordance with it.

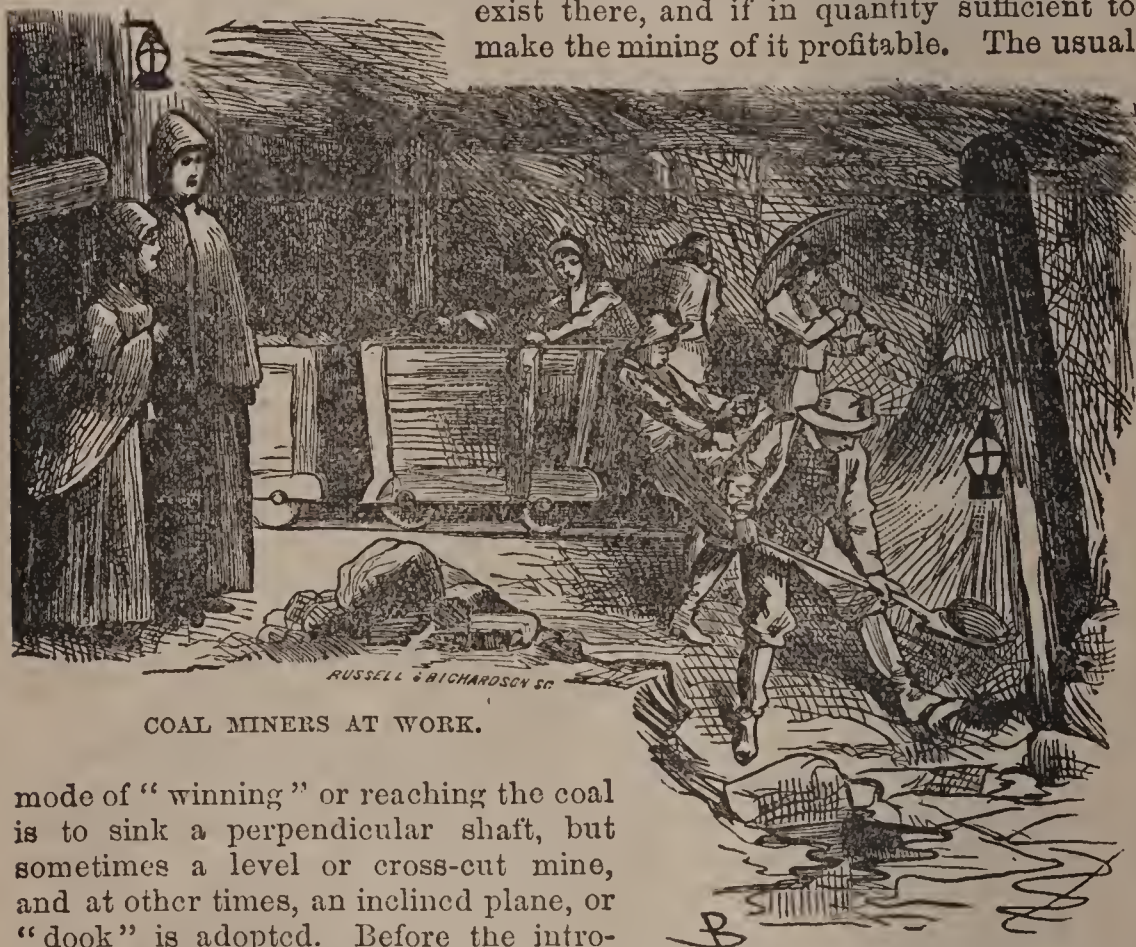
Diamonds are cut into various forms, but principally into *brilliant*s and *rose diamonds*. The *brilliant* cut is the most expensive and difficult, but is also that which best brings out the beauty of the stone; it has an upper or principal octagonal face, surrounded with many facets, and other things being equal, the greater the number of facets the more valuable is the diamond. The lapidaries of the East, however, sometimes multiply facets to hide imperfections of the stone. *Rose diamonds* have a flat base, above which are two rows of triangular facets, the six uppermost uniting in a point. Rose diamonds are made of those stones which are too broad in proportion to their depth to be cut as brilliants. Stones still thinner are cut as *table diamonds*. The art of sawing diamonds, when too thick in proportion to their surface, was invented by a Dutchman named Dalbeck in the beginning of the nineteenth century.

Coal.—The minerals of the carboniferous formation, at least those which occur in beds or strata, as coal and clay ironstone, are mined in a different way from metallic veins. Originally deposited in a horizontal position, they have been so altered by movements in the earth's crust, that they are rarely found so now. They are more generally found lying in a kind of basin or trough, with many minor undulations and dislocations. But however much twisted out of their original position, the different seams, more or less, preserve their parallelism, a fact of great service to the miner, since beds of shale, or other minerals, of a known distance from a coal

seam, are often exposed when the coal itself is not, and so indicate where it may be found.

The great progress made of late years in the science of geology has made us so minutely acquainted with all the rock formations above and below the coal-measures, that it is now a comparatively easy matter to determine whether, in any given spot, coal may or may not be found. Nevertheless, large sums are still occasionally, as they have in past times been very frequently, wasted in the fruitless search for coal, where the character of the rocks indicates formations far removed from coal-bearing strata.

When there are good grounds for supposing that coal is likely to be found in any particular locality, before a pit is sunk, the preliminary process of "boring" is resorted to, in order to determine whether it actually does exist there, and if in quantity sufficient to make the mining of it profitable. The usual



COAL MINERS AT WORK.

mode of "winning" or reaching the coal is to sink a perpendicular shaft, but sometimes a level or cross-cut mine, and at other times, an inclined plane, or "dook" is adopted. Before the introduction of pumping-engines, all coal-workings were drained by means of a level mine called a *day-level*, driven from the lowest available point on the surface, and no coal could be wrought at a lower depth than this, because there were no means of removing the water.

When the shaft has been sunk to the necessary depth, a level passage, called the *dip-head*, or *main-level*, is first driven on each side, which acts as a roadway or passage, and, at the same time, as a drain to conduct the water, which accumulates in the workings, by means of a gutter on one side, to the lodgment at the bottom of the shaft. This level is the lowest limit of the workings in the direction of the dip, and from it the coal is worked out as far as is practicable along the rise of the strata. There are two principal methods of mining the coal. One is termed the "post-and-stall" or "stoop-and-room" system, and is used for thick seams; the other is called the "long-wall" system, and is adopted for seams under four feet in thickness.

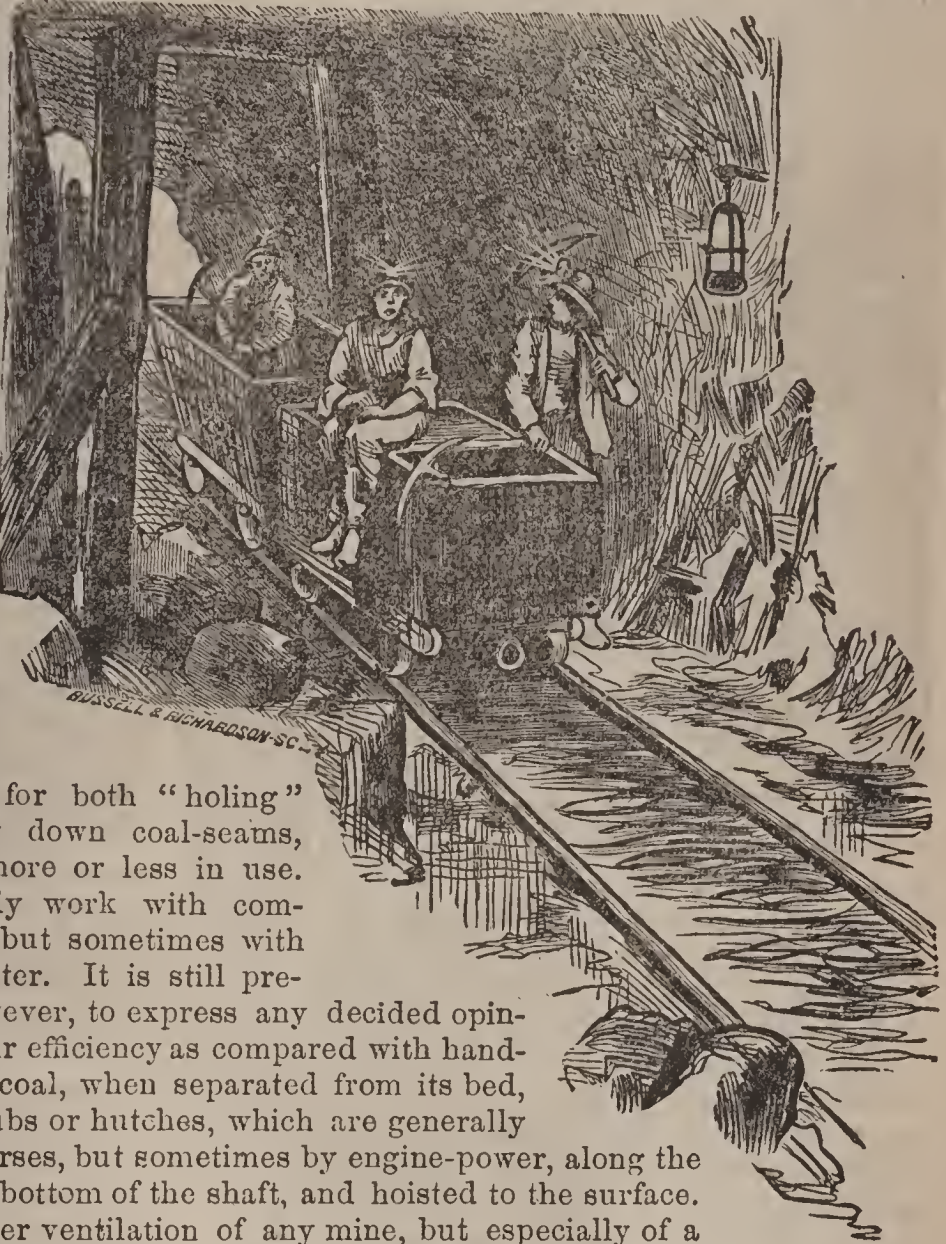
The *long-wall* system consists in extracting the entire seam of coal at the first working, the overlying strata being supported by the waste rock from the roof of the workings. It is necessary, however, to leave large stoops at the bottom of the shaft for its support, as in the stoop-and-room method. In long-wall workings, roads of a proper height and width require to be made for communication with the different parts of the mine.

The collier's usual mode of extracting the coal from its bed is this: With a light pick, he undercuts the coal seam, technically termed "holing," for

two or three feet inward, and then, by driving in wedges at the top of the seam, he breaks away the portion which has been holed. Blasting is occasionally, but not often resorted to. For the past ten years machines, some for "holing"

and others for both "holing" and hewing down coal-seams, have been more or less in use. They usually work with compressed air, but sometimes with steam or water. It is still premature, however, to express any decided opinion as to their efficiency as compared with hand-labor. The coal, when separated from its bed, is put on tubs or hutches, which are generally drawn by horses, but sometimes by engine-power, along the roads to the bottom of the shaft, and hoisted to the surface.

The proper ventilation of any mine, but especially of a coal-mine, is of very great importance. It clears the mine of the dangerous gases, fire-damp and foul damp, dries the subterranean roadways, and furnishes the miners with a supply of pure air. It is very difficult to secure efficient ventilation through all the zigzag windings of a mine; hence the frequent and terrible explosions of fire-damp, or light carburetted hydrogen, which explodes when mixed with a certain proportion of atmospheric air; hence, also, the occasional accumulation of foul-damp (carbonic acid) in some pits, which suffocates any one breathing it. This deadly gas is always produced in large quantity by an explosion of fire-damp, and chokes many who have survived the violence of



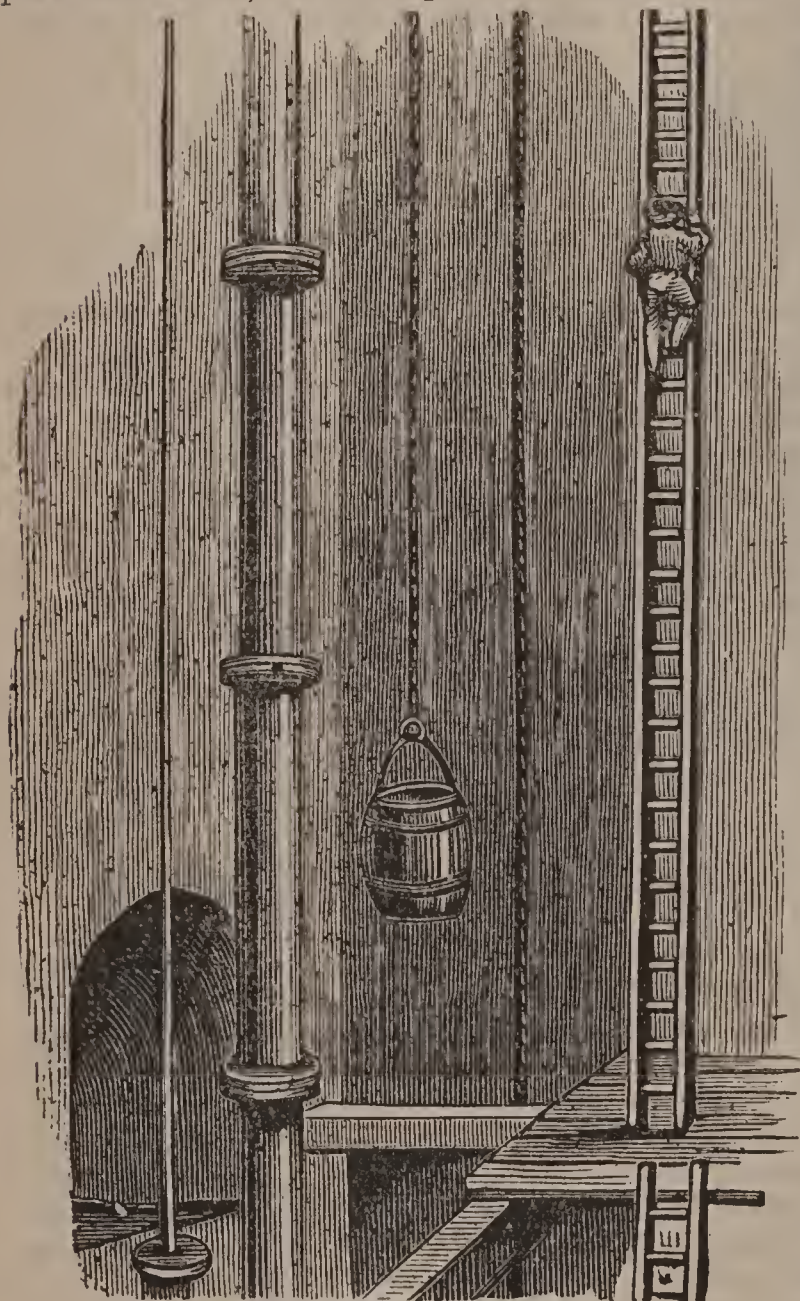
COAL-CARS.

the explosion. Many collieries are so free of fire-damp that the miners work with naked lights, but in others it is necessary to use the safety lamp.

Copper.—Copper when pure is of a singularly red color, exceedingly malleable and ductile; it can be hammered when red-hot; it is not so hard as iron, but nearly as tenacious; and is remarkable for not corroding by exposure to the air; immense quantities of it are used in this country for cop-

pering the bottoms of ships, for coinage, and for a multitude of household utensils, etc., as well as for making brass.

Copper appears to have been well known to the nations of antiquity, and often when *brass* is mentioned in old books, *copper* must be understood; as for example, the passage in Deuteronomy, which describes “a land whose stones are iron, and out of whose hills thou mayest dig brass.” Copper, both for working by itself and for the manufacture of brass, was early obtained from Egypt, one of the chief sources of the wealth of the Pharaohs being the copper mines of the adjacent countries of Nubia and Ethiopia; copper was known too in Greece, from the earliest settlement of the country. There is a curious collection of Scandinavian



INTERIOR OF A SHAFT.

antiquities at Copenhagen, in which are many swords, knives, and daggers, the blades of which are made of gold or copper, with an edge of iron; proving, by the parsimony with which the latter metal was used, how much more abundant were the other two.

The mines which supply the copper of commerce are situated in almost all parts of the world, a large proportion of which are worked by English companies, and made tributary to the great smelting establishment in South Wales. Copper mines are worked on the range of the Andes, the Cordil-

leras of Central America, and the Appalachians of North America, the geological formations of these mountains being productive of copper ore. In the Eastern and Middle, Southern and Western States, copper mines exist, the most famous of which are those of Lake Superior.

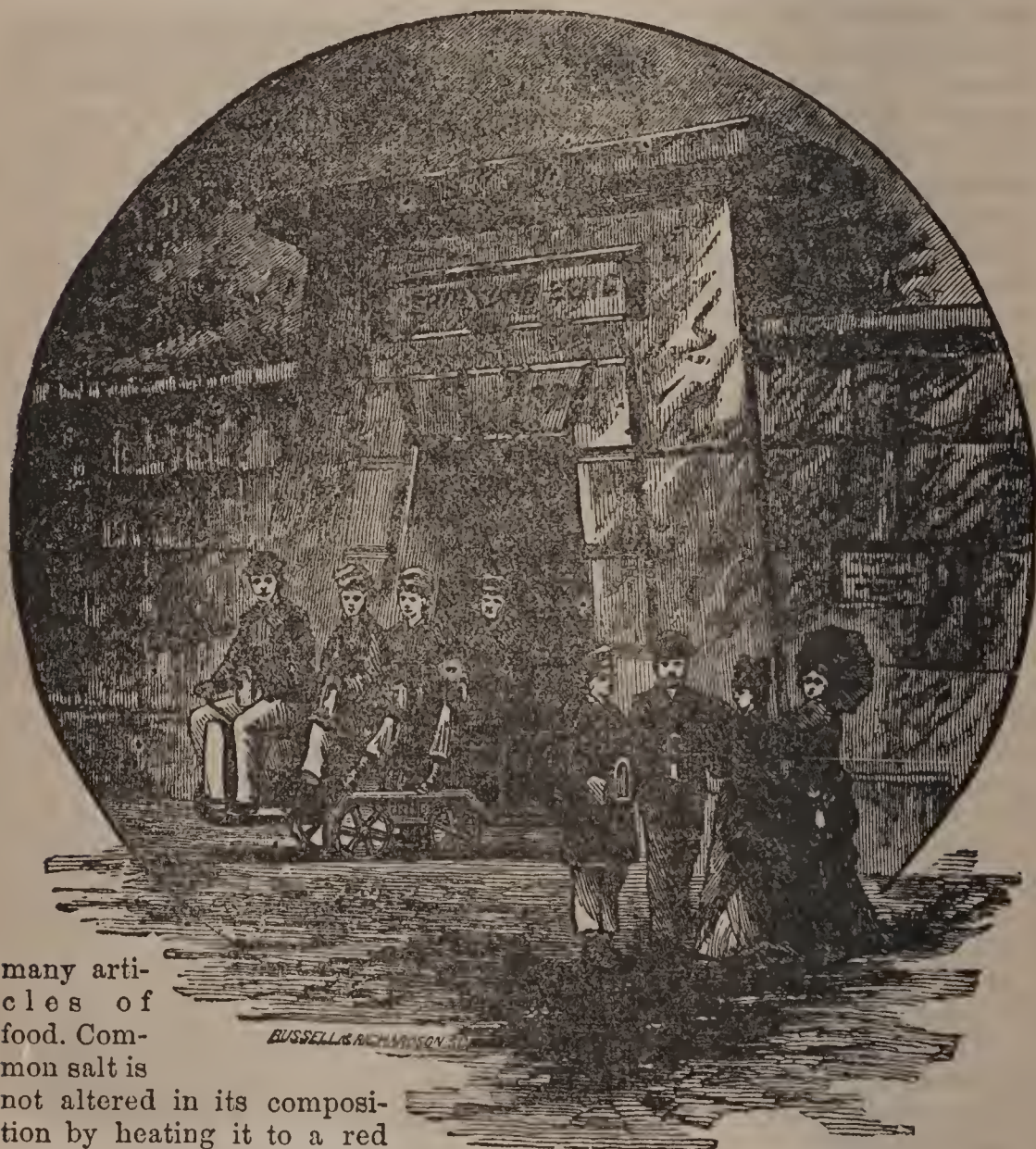
All that is visible on the surface of a copper mine is usually several buildings, more or less rude in structure, containing the engine, the steam-pump, etc., and a number of sheds where the copper ore is stowed as it is brought to the surface, and picked over by women and girls, who, with a little mallet knock off the unproductive pieces; leaving only such as will pay the expense of working it; all that they throw out is carried away in barrows, and added to the heap of refuse, which in time becomes one of the most conspicuous features of the mine, when seen from a distance. Another characteristic, too, is the mountain stream, which, instead of running clear and pure as before it reaches the mine, flows on thick and black, or dingy gray, and so charged with metallic matter as to be anything but fertilizing in its progress. There is a curious copper mine in Cornwall, only a few miles from the Land's End, which is called the Botallack Mine. Approaching it, you see the various buildings and machinery connected with the mine, not grouped together on the level ground or hillside, as is usual, but scattered up and down the precipitous face of the cliff, on all the available ledges of rock, where there would appear to inexperienced eyes to be only space enough for a gull's nest, the sea breaking and roaring at the bottom. This mine, which is worked to a very great depth, is carried out several hundred yards from the shore, below the bottom of the sea; and as you traverse its narrow and dark passages, you may hear the low moaning of the ocean far above your head; when the weather is rough, and the sea runs high, this dim, mysterious sound is increased into a roar, fierce and awful beyond all imagination; and such is the horror of the miners, that, though so long accustomed to the spot, they seldom continue working when a storm occurs, but find their way back to the upper air. The galleries of this mine are very damp, the salt water from above forcing its way through numerous crevices too minute to be seen, and dripping slowly on the floor.

Sometimes, in small quantities, copper is found pure, and veins of copper are not unfrequently visible in cliffs laid bare by the sea. It is remarkable that, while there are hardly more than four or five different sorts of tin ores, and only one at all common, those of *copper* are almost innumerable; in one collection in Cornwall a thousand varieties are shown. One poor ore, the green carbonate of copper, is now become familiar to the world as the beautiful green stone called *malachite*; which is used for ornamental purposes. The richness of the ores varies very much, and consequently their value. A large quantity of the Cornish copper ore is conveyed to South Wales to be smelted there, because of the abundant supply of fuel which the Welsh coal mines afford; the vessels which convey the copper ore, load back with coal to feed the mining steam engines.

To obtain pure copper, the different ores are well mixed, this being desirable, as one ore often acts as a flux to others; the whole is then calcined, remaining twelve hours in the furnace, from which it is raked out black and powdery. The next process is smelting, during which the slags, or earthy parts, rise to the surface and are cleared off, the metal being run out into pits filled with water, which causes it to become granulated. These two processes are repeated twice more, and then the metal is roasted again; which oxidizes the iron and other metals still combined

with the copper. Nothing now remains to be done but refining and toughening; the latter is a curious process; the metal in the furnace is covered with charcoal, and a pole of birch wood is stirred in it, this causes ebullition, and the grain gradually becomes finer, the color a lighter red, and the metal more malleable.

Salt.—Salt in its popular sense is a crystalline mineral substance, white and sparkling, with a sharp pungent taste; and is used to cure and season



ENTRANCE TO THE MINE.

many articles of food. Common salt is not altered in its composition by heating it to a red heat; it is not soluble in spirit; and, which is remarkable, hot water scarcely dissolves a larger portion than cold; crystals of salt, therefore, cannot be obtained by cooling a solution of it, but by evaporation. The natural form of the crystals of salt is a cube, but when formed at a high temperature they are deposited much more rapidly, and are hollow pyramids.

Salt being one of the necessities of life, we find it by the kind care of Providence stored up in every land; every nation has access to it either in the form of salt springs or mines, or can obtain it from the sea. These

sources form "the inexhaustible storehouses of our household salt—all that we employ in our fisheries, in our meat-curing establishments, in our agriculture, in our soda manufactories—all that fuses our glass, and fertilizes our fields, imparts the detergent quality to our soap, and gives us salt herrings and salt pork; and every thing else salt that is the better for being so, down to our dinner celery and our breakfast eggs."

In preparing salt from the brine springs, the brine is pumped by steam power into reservoirs in which are placed pieces of rock salt, that no fuel may be wasted by evaporating an unsaturated solution; from these reservoirs it is drawn off as wanted into evaporating pans; these are made of wrought iron; they are shallow and oblong, and contain from six hundred to one thousand superficial feet; there are three or four fires in each pan. The various kinds of salt are produced by the different degrees of temperature at which the water is evaporated and the crystals formed; the less heat is applied the larger the crystals are. The time occupied varies from twelve hours employed in making stove-salt to five or six days needful to make large-grained or fishery salt; when the crystals are formed at the bottom of the pan they are raked out and heaped up in conical baskets to drain.

Besides the rock salt found in England, salt mines have been discovered in Austria, Hungary, Russia, the Tyrol, Sweden, and many other parts of Europe; the principal of these are the mines of Bocknia and Wieliczka, belonging to the Austrian government. They were originally worked in the year 1250, and were carried on in a very rude manner for five hundred years.

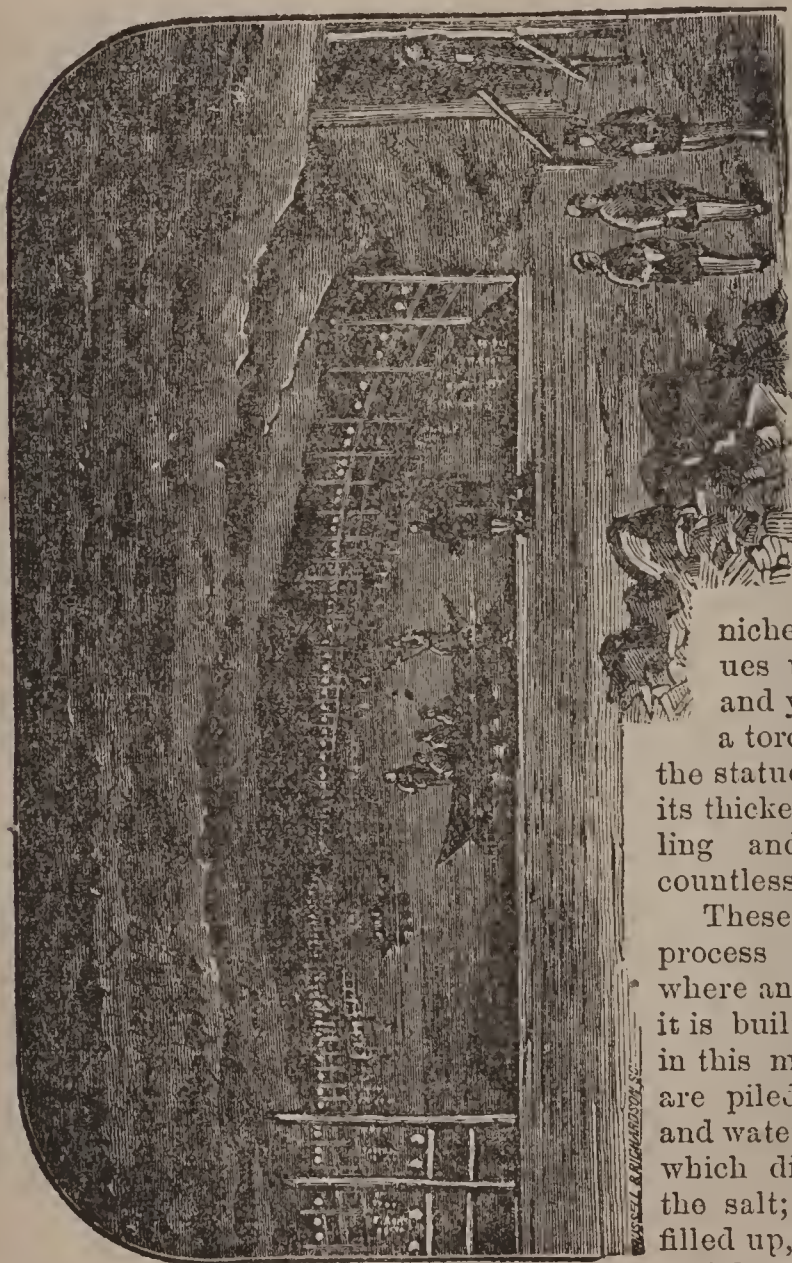
The mine of Wieliczka measures with all its galleries thirty English miles, its greatest depth is one hundred and forty-five fathoms; it is divided into three distinct compartments, called fields; each of these consists of five stories one below the other, and each story is made up of numerous cham-



PASSAGE TO THE MINE.

bers, cells and caverns, connected by passages; the descent is made by staircases and shafts; the staircases are carved in rock salt, and are some of them very magnificent, no dirt or disorder is visible anywhere; and as there are no springs of water at so great a depth, the air is quite dry, and everything is kept in the most perfect state of preservation, there is a strong current of fresh air through the passages, and noxious gases are never met with in salt mines.

Many of the excavated chambers in this mine are one hundred or one



THE ILLUMINATED LAKE.

hundred and fifty feet high, and eighty or one hundred feet long and wide; some are used as storehouses, and others as chapels, ball-rooms and dining-halls on occasions of festivity. In the chapels every thing is carved out of rock salt; altars, walls, ceilings, doors, crucifixes, niches, pedestals and statues upon them; all solid, and yet so translucent that a torch held behind one of the statues shows light through its thickest part; and all sparkling and glittering as with countless diamonds.

These halls are left in the process of excavation, and where any addition is required it is built with salt and water; in this manner, masses of salt are piled one upon another, and water is thrown over them, which dissolves a portion of the salt; the crevices are thus filled up, the water evaporates and leaves the whole a solid

mass; columns of salt are always left to support the roof. In some mines the chambers after excavation are flooded with fresh water, which, after remaining several months to get saturated, is drawn off and evaporated in the usual manner. In other places, where weak brine springs occur, the solution is allowed to drip over compact bundles of fagots, or to trickle down ropes; by which means it is much exposed to the air, and part of the water is economically evaporated before boiling commences. When sea water is used for making salt it is always exposed to the sun in shallow

ponds until the quantity is very much reduced. In Russia, Persia, Abyssinia, and many other countries, salt deserts occur; tracts of land where salt is so abundant, both on the surface and beneath it, that it can be obtained with little more trouble than collecting it; these tracts are quite barren, and after a shower are covered with a white incrustation of salt resembling a fall of snow. At Cardona, in Spain, the rock salt appears on the surface, and even forms a precipice four or five hundred feet high, overlooking the valley; this is quarried as any ordinary rock might be, and the salt is so pure as to need only grinding to fit it for use.

A lady writer gives the following entertaining description of a visit to an Austrian salt mine:

"We started at nine o'clock one morning in August to visit the wonderful salt mines at Berchtesgaden, about twelve miles from Salzburg, on the Tyrol-Austria. A regular business is made by the government of exhibiting this mine, so we experienced no delay in getting tickets of admission, a guide and change of dress. We were provided with coarse dresses, the ladies removing part of their garments, and putting on pantaloons, with a dress or sort of coat, extending to the knees, a funny-looking woolen cap with white bands for head, a belt around the waist, with miner's lamp hung on in front, altogether forming an odd costume. The gentlemen were changed into miners (in appearance), with rough felt hats, and rougher coats.

"We employed a guide, and followed him, first passing through a doorway into long narrow passages, about ten feet high and six feet wide, for a distance of five hundred feet. These passages were splendidly walled with granite. When the granite walls ceased, the same passage continued through crystal salt, which is so solid as to need no walling. We passed up one hundred and twenty-six granite steps and down others. Pipes were on each side of the passage, one for salt water, and one fresh. We traveled on for some time, passing various passages branching off from the one we were on. Suddenly we were startled by the scene presented. I hardly know how to describe it. Imagine a salt lake in the center of the mountain, three hundred feet long, two hundred wide, brilliantly illuminated by over two hundred lamps. The ceiling was of solid rock salt, twenty feet above, and had no supports, and needed none, although some thousand feet of mountain "clothed with pines" was over our heads. A boat was moored to the shore of the lake, and in this we took seats, and were soon rowed to the opposite side of the lake, landed on a platform, and shown the manner in which the fresh water drips through masses of crystal salt.

"Passing on, we came to a long flight of steps, a place where it was necessary to avoid the weariness and time caused by descending the stairs by sitting on a board at the side of the stairs, and *slide!* First, the guide took a seat, then we followed singly, with our hands on the shoulders of our companion in front of us, in the same way as boys coast down hill. Our guide regulated our speed by a guide-rope, which he allowed to pass rapidly through his heavily-gloved hand. We slid down a distance of eighty feet, at an angle of forty-five degrees. It was a frightfully rapid journey, but thanks to the skill of the miner, he landed us on our feet at the bottom with scarcely a perceptible jar.

"Soon we came to a huge cave, a gallery surrounding it hewn out of rock, and provided with a railing. Looking down, it was one hundred feet deep, and about as many wide, feebly lighted by miners' lamps, the miners being busy at work. Again we came to a point where another sliding board

was erected, down which we slid the hundred feet intervening between us and the bottom of the cave. The bottom was reached as safely as before. We reascended to another part by means of an inclined plane used for hauling the rock salt out of the cave, then our guide led us through a long passage hewn out of rock salt until we came to a small illuminated chamber. After admiring the novelty of the scene, we were invited to sit astride a long bench, with wheels fitting into a rail-track. The guide sat in the front end of the bench, having control of the brakes. We dashed along, turning curves at railroad speed; our lamps were extinguished by the rapid speed, and when we at last could perceive, a long way ahead of us, a glimmer of daylight, the sensation was pleasing. On we sped, until suddenly we flew out into the open air, and landed safely at the point from which we started, and found a crowd of visitors, arrayed in miner's garb ready to enter."

Lead.—Lead was largely worked by the Romans in Great Britain, and pigs with Latin inscriptions have been frequently found near old smelting works. The mining of lead in England was formerly regulated by curious laws; some places, such as the King's Field, in Derbyshire, having special privileges. It was the custom in this district not to allow the ore to leave the mine till it was measured in the presence of an official called a *bar-master*, who set aside a twenty-fifth part as the king's cope or lot. Up to a comparatively recent period, persons were allowed to search for veins of the ore without being liable for any damage done to the soil or crops.

Lead ore is pretty generally distributed, but by far the largest supply of this metal is obtained from Great Britain and Spain, the former country yielding some seventy-five thousand tons per annum, and the latter probably an equal supply. Nearly a fourth of the total British produce is procured from the Northumberland and Durham district, where there exists, at Allenheads, one of the largest mining establishments in the world. Scotland and Ireland furnish only a very small quantity. In the region of Lake Superior, in the States of Michigan and Wisconsin, are extensive and valuable lead mines.

With the exception of a little from the carbonate of lead, all the supplies of this metal are obtained from the sulphide of lead or Galena. This mineral contains a little silver, and sometimes copper, zinc, antimony, or selenium. It is of a lead gray color, with a metallic lustre, is found massive, or sometimes granular, or crystallized in cubes or octahedrons. It is very easily broken, and its fragments are cubical. It occurs in veins, beds, and imbedded masses, often accompanying other metallic ores, in primitive and secondary rocks, but most of all in what is known as transition or mountain limestone.

The lead ore, when taken from the mine, is broken up into small pieces, "hotched," and washed, to separate impurities. Sulphide of lead, when tolerably pure, is smelted with comparative ease. It is first roasted in a reverberatory furnace. From twenty to forty hundredweight of galena are put into the furnace at a time, either with or without lime. In about two hours the charge becomes sufficiently roasted. During the process, the larger portion of the ore takes up four equivalents of oxygen, and becomes sulphate of lead; a little oxide of lead is also formed, while another portion remains unaltered as sulphide of lead. After it is roasted the ore is thoroughly mixed together, and the heat of the furnace suddenly raised. This causes a reaction between the unchanged and the oxidized portion of the ore, and reduces much of the lead, sulphureous acid being at the same time evolved.

In the third stage, lime is thrown in and mixed with slag and unreduced ore. When this becomes acted on, the whole of the lead is practically separated from the ore, and is then run off at the tap-hole.

In some districts the roasted ore is smelted on a separate ore-hearth called the Scotch furnace, where the heat is urged by bellows. Peat and coal are used as the fuel. This is a slower mode of smelting than the last, but yields a purer lead.

During the operation of smelting a considerable quantity of lead is volatilized and carried off as *fume* or *smoke*, which, when allowed to escape into the atmosphere, not only involves a loss of lead, but destroys all vegetation for some distance around the works, and poisons cattle and other animals feeding near them. Much attention has of late been paid to the obviating of these evils, and several plans are in use for the purpose. Where it can be done, no method is more effective than simply conducting the smoke from the furnaces through a long horizontal flue—say a mile in length—to a vertical stack. The fume condenses on the sides, certain openings being left for the purpose of collecting it. About thirty-three per cent. of the fume thus recovered consists of metallic lead.

When lead contains antimony and tin as impurities, they are separated by fusing the metal in shallow pans, and allowing it to oxidize at the surface. In this way the antimony and tin form oxides, and as such are skimmed off. Lead reduced from galena always contains a little silver, of which eight or ten ounces to the ton is a very common proportion, although it often exists in much larger quantity.

Tin.—Tin is a white metal, bright and silvery; it is elastic, and consequently sonorous; ductile, very light, and it fuses at a much lower temperature than is necessary to heat it red hot.

Tin is found in America, England, and some parts of Germany; but the largest supply comes from the Malay peninsula and the adjacent islands; this is called Banca tin from the place of its export.

The tin mines of England early attracted more civilized nations to their shores; the Phœnicians traded there for tin six hundred years before Christ, and are said to have first given a name to Cornwall, in which county the tin mines of England are chiefly situated, calling it from its form and projecting position by a Phœnician word, which signified a *horn*, from which appellation are derived both the Latin *Cornubia* and the English Cornwall. The Greek colonists at Marseilles, and the Romans, came also to England for tin, and these last gave the name of Cassiterides, or Tin Islands, to the Scilly Isles, or perhaps to St. Michael's Mount, and some adjacent rocks, where, as Diodorus Siculus relates, the natives carried their tin in little carts at low water, to barter with their more civilized visitors for the much coveted produce of southern climes.

The ancient mines were probably stream-works open to the surface, where the metal is exposed by washing. Pickaxes of holm, boxwood, and even of horns of different animals, have often been found in these kinds of works; the rude instruments of a people little removed from barbarism. During the time of the Normans great wealth accrued to the Earls of Cornwall from dues and imposts on tin payable to them, and these still continue to be paid to the Dukes of Cornwall, the blocks of tin being *coined* or stamped with the seal of the duchy after the dues have been paid.

Tin is found in veins or fissures called locally *lodes*—their direction is mainly from east to west, and they branch out and divide like the boughs

of a tree, diminishing till they terminate in mere threads. Tin is also found in a dispersed form in loose stones, which, when found continuously, are called streams. The most common tin ore is very hard and glass-like.

Tin mining is carried on with great activity, and often at a great expense, which arises from the galleries having to be supported with large timber. The most remarkable mine in England is one which has long been abandoned on account of its danger; this, the Huelcok, is carried under the bed of the ocean below low-water mark; and, in one place, where the rich vein ran upward, the improvident miners pursued it till only four feet of rock were left between the mine and the bed of the sea, which could be distinctly heard howling and roaring, the rolling of the masses of rock moved by the waves sounding like repeated peals of thunder. Another mine, called the Huel Ferry, is entirely submarine.

Zinc.—Zinc is a metal which has been comparatively lately discovered in its pure form, though one of its ores, calamine stone, has long been known and used. It abounds in China, and the Chinese were the first to use it; they also exported it in large quantities to India, whence much was imported to England, until it was discovered that they possessed ores of it themselves. The largest proportion of zinc, or spelter, as it is frequently called in its metallic form, is obtained from the German states, who not merely supply the home markets, but have superseded the Chinese in the trade in India. Zinc is a hard, bluish-white metal, not malleable when cold, breaking readily under the hammer, and showing particularly brilliant crystalline fracture; but at a moderately high temperature it possesses great malleability and ductility, can easily be drawn into wire and rolled into plates, and worked in other ways. Zinc is well suited for casting figures; it melts readily, liquefies completely, and therefore copies every line of the mold more accurately than harder metals. A cast can be made in zinc for one-sixth or one-eighth the cost of bronze, and can afterward be bronzed so as to look almost as well as that metal. Zinc plates are used for many purposes, and in roofing they are valuable for their lightness, being about one-sixth part the weight of lead ones; they are not liable to rust or corrode from exposure to the air; many vessels are now made of zinc, and for galvanic apparatus this metal is used.

Quicksilver.—The metal used in barometers and thermometers to show the changes in the atmosphere, is called *Quicksilver* or *Mercury*. It is white, rather bluer than silver, and as it is from its great fusibility habitually fluid, it readily unites with many other metals and imparts to them a degree of its characteristic quality; when these metallic mixtures contain sufficient mercury to render them semifluid at a mean temperature they are called *amalgams*. Mercury is likewise employed for silvering looking-glasses and for gilding, in which latter process the gold and mercury are laid on together in the form of an amalgam, and the mercury afterward dissipated by the action of heat. It is also employed in the preparation of several powerful medicines, and in the manufacture of vermilion. But by far the largest quantity of mercury is used for amalgamation with native gold and silver to facilitate the extraction of the pure metal. The chief mines of mercury, or quicksilver, are in Spain, in the provinces of Asturias and Andalusia; there are mines, too, at Idria, in Carniola, which are very productive, and others in Tuscany and California. Mercury is found both native and mixed with sulphur, in which state it forms the red ore called *cinnabar*.

WONDERS OF THE SEA.

Sea Anemones.—Brilliant as the hues of the rainbow, and as varied in color, a group of anemones in their native element might be compared to a basket of freshly gathered flowers. In examining the delicate fringes, as they wave gracefully in the water, one can almost imagine a fragrance arising from blooms so perfect. Ancients thought they were flowers. Poets sang of the "Roses of the Sea;" and in reading their lines of mystery, one cannot but exclaim:

"Oh, ye delicious fables! When the wave
And wood were peopled, and the air, with things
So lovely, why, ah, why has science grave
Scattered your great imaginings?"

Believing them to be flowers, I was once examining some beautiful orange-colored specimens, fully expanded. While watching the graceful waving of the tentacles, a shrimp was suddenly grasped by them, held, and literally "tucked in" the opening of the anemone.

Calling in dismay a scientific friend, I learned that the beautiful object was an animal, that boasted of a ravenous appetite and strong digestive organs; but yet, though obliged to accept the disagreeable fact "that all things beautiful are not what they seem," I must confess that my interest increased rather than diminished.

The anemone is a polyp—which word means "many-footed." Its anatomy is most peculiar. It is formed of two tubes, or sacks, one within the other, and has the appearance of having been originally one long tube, the end of which has been turned in, leaving a round margin, crowned with many rows of tentacles, which make a thick, soft fringe.

The inner tube, with an opening at the bottom, is the stomach, and the outer tube, with closed, flat base, is the body. There are vertical partitions between the stomach and body, which divide the space into chambers and openings in these partitions, through which, in connection with the opening in the stomach, currents of water circulate.

The mouth is the large opening at the top, and into it is taken an incredible quantity of food. The shrimp is the favorite morsel, but worms and small mollusks are by no means ignored; the latter are swallowed whole, the shell after a time being ejected.

Each one of the tentacles, which are so graceful and appear so harmless, is provided with a number of coiled-up threads, called lasso-cells, so minute that they can be seen only with a microscope, and which, when thrown out, both poison and entangle the prey.

The flesh of collectors of marine animals is often badly poisoned by them. When food is secured, it is grasped by the tentacles and passed into the stomach, though many a dainty morsel is snatched away by a neighboring marauder. When food is taken the anemone withdraws its tentacles, folds up, and while digestion is going on, appears to sleep. After a time it expands slowly, by filling with water, which is taken in chiefly at the mouth.

Yet, though having so ferocious an appetite when food can be obtained, the anemone is so constituted as to exist months without nourishment. Naturalists reason that this is a compensation of nature when animals are unable to go in search of food.

This creature, though so beautiful in structure, has no intelligence and but little instinct. It does not seem to be even conscious of prey until the prey actually comes in contact with the tentacles. These are sensitive when touched, however, and shrink up quickly into a solid round mass.

The large tanks at the New York Aquarium were connected, and one of the naturalists who is considered good authority told me that when feeding animals in a tank near the anemones, they became agitated, and fully expanded the tentacles.

This would prove that there is a slight sense or smell, or some instinct yet unacknowledged.

Almost incredible is the fact that the anemones are reproduced in four ways.

The first and most reasonable is by eggs, which are formed and developed upon the

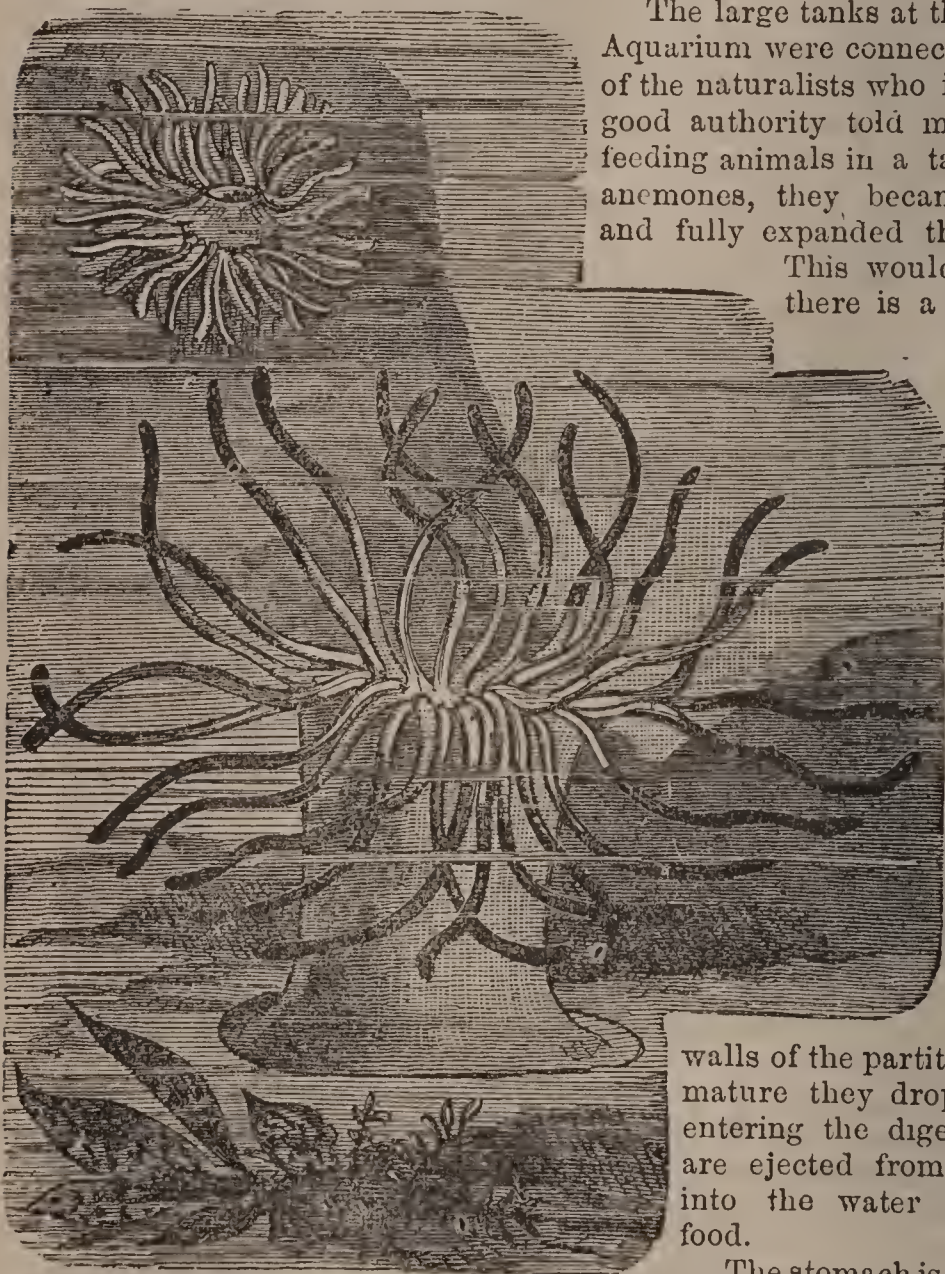
walls of the partitions. When mature they drop down, and entering the digestive cavity, are ejected from the mouth into the water with refuse food.

The stomach is wonderfully accommodating, and fulfills a multitude of functions, re-

ceiving, swallowing and rejecting, a continual rejecting seeming a normal condition.

They increase, also, by budding like trees and shrubs. A slight swelling arises on the side of the body, or at the base, then gradually enlarges, becomes perfect in form, and drops off. Several have been seen on one parent.

They also multiply by self-division, or by being cut into particles with a



TROPICAL ANEMONE.

knife. I have often severed them vertically also, horizontally, and each section has become a perfect anemone. The fourth and strangest reproduction is when detached particles become perfect specimens.

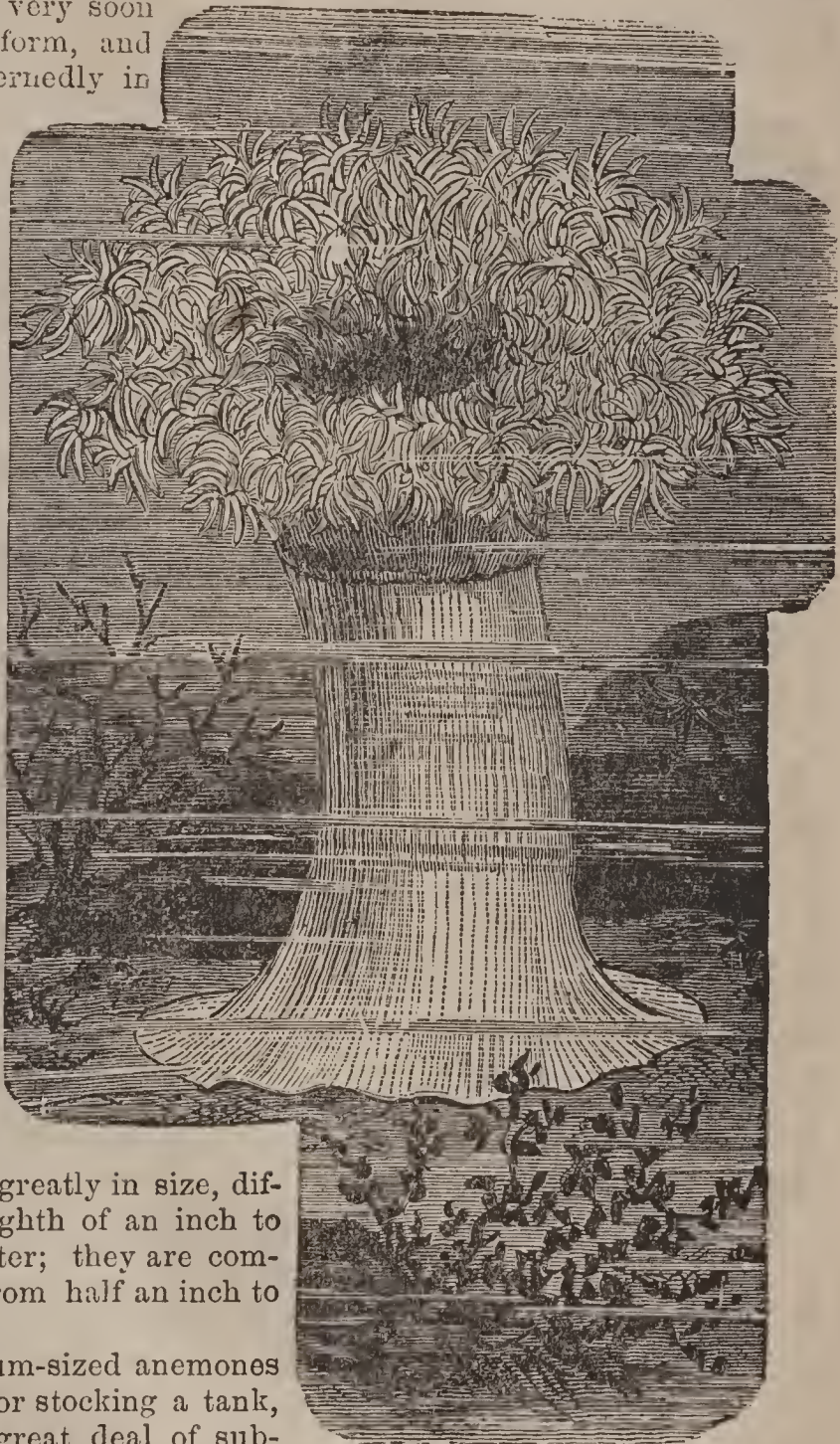
The anemone attaches itself to foreign substances by the flat base, and a parent in loosening its hold will often tear away and leave little particles; each of these will very soon assume life and form, and move off unconcernedly in search of new quarters. Young anemones have at first but one row of tentacles, but they increase gradually outside.

Anemones often assume an hour-glass-shape, and freak in form, having double discs and double bodies. There is no distinction in sex, each animal being perfection in itself.

Though seeming at most times stationary, the anemones are able to move themselves slowly by a successive contraction and loosening of the base, thus stretching forward one side and gradually drawing along the other. They vary greatly in size, differing from one-eighth of an inch to one foot in diameter; they are commonly, however, from half an inch to three inches.

Small or medium-sized anemones should be chosen for stocking a tank, as they absorb a great deal of substance and are very prolific. In large public tanks, an excess often has to be removed. When needed for dissecting purposes, drop in cold fresh water to kill.

These animals are hardy and long-lived, and accounts are given us where people have kept them five, ten and fifteen years. I know of a piece of rock covered with anemones being taken from the water at Wood's Hole,



FRINGED ANEMONE.

Mass., during the summer. It was left to dry on the beach for twenty-four hours as an experiment, then returned to the water, and each animal assumed life and perfect form.

In our climate, as winter approaches, the anemones loosen their hold and sink into deeper and warmer water. There is a European anemone which attaches itself to the shell of one variety of hermit crab, and is carried about gallantly. It is an established fact, also, that the hermit when taking up abode in a new shell loosens the anemone from the old one and carries it and places it on the new.

It would be a difficult matter to decide which of the anemones, either in form or color, are most beautiful. Those from the tropics are most brilliant, and look like flowers from dreamland. Stems of shaded orange are crowned with tentacles of gray, tipped with crimson; light pink standards bear fringes of white, and a base of velvet-like crimson often supports streamers of pink, white and gray.

Some anemones erect themselves to the height of four and six inches, and have the finest and daintiest of fringe. The "crassicornis" is shorter and wider mouthed, and has thick, short tentacles. The white armed anemone is more slender, and is so transparent that all organs are discernible.

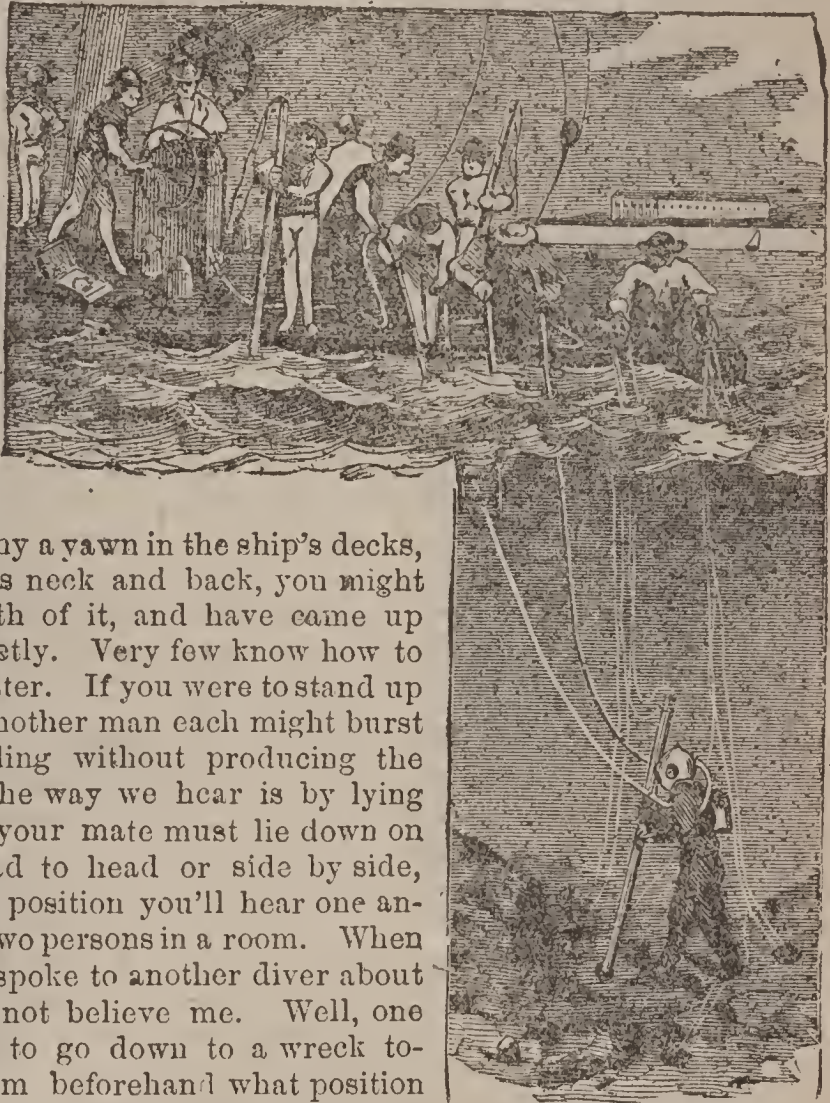
There is a beautiful maroon anemone with green spots, found in English waters, with medium-fine tentacles, and crassicornis varieties less brilliant than our own. I recently saw a variety of German anemones (the first ever exhibited in this country), and in beauty of form and variety of color, they excelled anything I have ever seen. They were attached to the fat, round. German oysters, and fully expanded. The fringes were beautifully delicate, and the shades, of clear orange, cream, velvety-gray and pure white, could not be equalled by the dyes of our choicest silk velvets.—*Ida Batty Roberts.*

The Diver.—The first sensation in descending under water in a suit of armor is the sudden, bursting roar in the ears, caused by the air driven into the helmet from the air-pump. The flexible air-hose has to be strong enough to bear the pressure of twenty-five to fifty pounds to the square inch. The drum of the ear yields to the strong external pressure, the mouth opens involuntarily, the air rushes into the tube, and strikes the drum, which strikes back to its normal state with a sharp, pistol-like crack. Peering through the goggle eyes of glass in his helmet, the diver sees the strange beauties about him clearly and in their own calm splendor. Above him is a pure golden canopy, while around him and beside him are tints and shimmering hues, including all colors, which are indescribably elegant. The floor of the sea rises like a golden carpet, inclining gently to the surface. The change in familiar objects is wonderful. The wreck of a ship seems studded with emeralds, glittering in lines of gold; piles of brick assume the appearance of crystals; a ladder becomes silver, every shadow gives the impression of a bottomless depth.

The following interesting information is given in a diver's own words: "I remember years ago going down to have a look at the wreck of the Forfarshire. I dived just out of curiosity, and saw the old hooker plain enough. Off that same coast I've been down in water so bright that I've stood among the weeds as tall as this room, a beautiful garden of them, and watched 'em with delight, almost to forgetting the job I was down there for, and I saw all kinds of fish swimming about and appearing quite close through the glass

in my helmet, though if I put out my hand to them I found them to be fathoms away. As a rule I can't see—no more than if I was looking through a London fog. And then take a ship. Suppose you were to come into this room at night without a light—you couldn't see. So it is with a ship's hold and cabin under water. It's pitch dark. A man can only grope. But it is not dangerous when you're used to it. A bit of a sea above is often inconvenient by making the vessel on the surface roll and tauten the tackle for heaving up the cargo, and so running up a mass of dead weight on a sudden before you're ready, and then letting it come down crash again. A ground swell—I mean the swell at the bottom—is also troublesome, for it'll swing a

man to and fro a distance of seven feet and more. But this is only on deck. It's quiet enough in the hold. Even should such a swell dash a diver against anything, however, it wouldn't hurt him. The dress makes him so light. I have



THE DIVER.

fallen through many a yawn in the ship's decks, fit to break a man's neck and back, you might think for the depth of it, and have came up again just as quietly. Very few know how to converse under water. If you were to stand up face to face with another man each might burst himself with yelling without producing the faintest sound. The way we hear is by lying down. You and your mate must lie down on your breasts—head to head or side by side, close, and in that position you'll hear one another as easily as two persons in a room. When I found this out I spoke to another diver about it, and he would not believe me. Well, one day we happened to go down to a wreck together. I told him beforehand what position to put himself in, and after we had been to work some time we came together and lay down as agreed, and I said: 'Jim, are there many more casks left in the hold?' 'Heaps,' he answered right off: 'And so you can hear me?' said I. 'Ave,' he answered, 'wonderfully plain,' and with that he laughed, and so did I, and we both heard each other's laugh just as we heard each other's words. We were in about eleven fathoms of water at the time."

The Corals of the Indian Ocean.—Of all the wonderful sights in this land of wonders, there are none greater than the wonders of the reef when the tide is low. The ideas about coral which people have who have

never seen it in its living state are generally erroneous. They know it as a beautifully white ornament under a glass shade, or in delicate pink branches in their jewelry, and they imagine living coral is like these. Their ideas are helped along by the common misnomer of trees and branches, as applied to coral. I have never seen it in the South Sea Islands, but throughout the Eastern seas the most common variety takes a laminated form, not unlike the large fungi to be met with any summer's day in an English wood growing out of the older trees. Flat, circular tables of dingy brown, growing over one another, with spaces under each. These attain a great size, extending for yards without a break, so that the bottom of the sea is perfectly level. This kind is much sought after by the lime-burners. Another species grows in detached bosses, like thick-stemmed plants which the gardener has trimmed round the top. These clumps grow out of the sand and stand up in dull brown against the white flooring. A third pattern is spiked like stags' horns tangled together, and is of a dingier brown than the first; its spikes collect the drifting weeds and its appearance is consequently untidy. There are scores of varieties of corals and madrepores, but the three mentioned are those which principally make up the mass which is ever growing under the still waters inside the reef. At Maheburg the reef is distant seven miles from the shore, and the whole of this great lagoon is in process of filling up by coral. There are one or two holes, left capriciously, and a channel which the river has cut to the reef, which it pierces in what is locally called "a pass." Everywhere else the bottom is only a few feet under water, and is always slowly rising. The various corals, the patches of silver sand, the deep winding channel, lend each a tint to the water—sapphire blue, where it is deepest, sea-green with emerald flecks, or cerulean blue shot with opaline tints, in the shallows. The reef is a solid wall, shelving toward the shore, absolutely perpendicular toward the ocean, and varies in width from twenty to one hundred yards. Against the outer face the rollers rage incessantly. Swell follows swell smoothly and regularly. There is no hurry, for here there is no shelving bottom to keep them back. On they come, separating their ink-blue masses from the tumble of the ocean, rearing aloft their crests, like live things anxious to try their strength, and fall with a roar on its edge as it stands up to meet them. You can stand within a few feet of the practically bottomless sea and watch them tumble, with the water no further than your knees, as the surge of their onward rush carries across the reef. To stand so and watch them coming on appears, to one unused to the sight, to court destruction, the wave is so vast, its crest rising higher as it advances, shuts out the sea beyond, nothing can be seen but a wall of water rolling on; its strength is apparently so irresistible, and the pause it appears to take as the top curls over seems to check your breath. The rocks and lumps of dead coral with which storms have strewn the reef are high and dry; the pools of limpid water in the holes sink down and drain away, their surface glassy, and their depths full of color and strange-shaped living things; then the roller breaks and sends a surge of water hissing by, and the reef has sunk beneath the foam and bubbling water.

Coral Fishing.—Coral fisheries on the coasts of Italy and Sicily begin about the middle of February, and continue till the middle of October. The value of the coral varies according to its color and size; the pale pink is the most prized, especially if it be of a uniform color throughout, without stains. Off Torre del Greco, near Naples, a large quantity of coral is found

every year; from four hundred to six hundred boats are sent out in search of it, each boat being of from six to ten tons' burden, with a crew of at least twelve men, and costing from \$2,500 to \$3,000 a boat. The valuable pink coral is found chiefly off the coast of Sicily. In the year 1873 a bed was discovered in the Straits of Messina, in which the coral, though found only in small quantities and of a small size, was of immense value, owing to its beautiful pink, of a uniform color, and without any of those stains which detract so much from its worth. Unfortunately, the supply of coral in this bed seems to have run short, and for the last few years coral merchants have not found it worth their while to send boats in search of it.

In 1875 a local bed was discovered about twenty miles off the coast of Sciacca, in Sicily, which was invaded for the next two years by seven hundred boats. This number, all crowded together in one spot, caused great



SHELLS OF THE INDIAN OCEAN.

confusion, and the Italian Government sent a man-of-war to keep order among the fishermen. Another similar bed was discovered in 1878, about ten miles farther from the coast, and in 1880 yet another still farther. The coral found off the coast of Sciacca does not grow, as at other places, attached to rocks, but is found clinging to any small object it can lay hold of, such as a shell or a fragment of coral. It is supposed that its dark red or black color is caused by the muddiness of the water in which it lives, although the depth of the sea at such spots is from three hundred to four hundred and fifty feet. This coral is not much esteemed in the English market, but is prepared in large quantities for the Indian market at Calcutta, by being exposed for months to the heat of the sun, and by being kept moist, when in time the black color gradually disappears. A few years ago a large quantity of Japanese coral found its way into the market at Naples, and fetched as much as \$750 the kilo, in raw branches, in spite of its being a bad color and somewhat cloudy. This high price was given on account of its extraordinary size—it was the largest real coral ever known.

Nothing has been heard of it since, excepting that the fishery was prohibited in Japan.

Shells of the Indian Ocean.—No sea shells are so beautiful as those found in the Indian Ocean. As the vegetation of tropical countries is of surpassing beauty, so do the waters of these climates yield the most wonderful and beautiful things. Our illustration will convey an idea of the magnificent shells found upon the shores of Southern Asia.

Pearl Fishing.—The most famous pearls are those from the East; the coast of Ceylon, or Taprobane, as it was called by the Greeks, having from the earliest times been the chief locality for pearl fishing. They are, however, obtained now of nearly the same quality in other parts of the world, as Panama in South America, St. Margarita in the West Indies, the Coromandel Coast, the shores of the Sooloo Islands, the Bahrein Islands, and the islands of Karak and Corgo in the Persian Gulf. The pearls of the Bahrein fishery are said to be even finer than those of Ceylon, and they form an important part of the trade of Bassora. These, and indeed all the foreign pearls used in jewelry, are produced by the pearl oyster. The shells of the molluscs which yield the Ceylon, Indian, and Persian ones, are sometimes as much as a foot in diameter, and are usually about nine inches. Those of the New World, although the shells are smaller and thicker, are believed to be the same species. The chief locality of the Ceylon pearl fishery is a bank about twenty miles long, ten or twelve miles from shore, opposite to the villages of Condatchy and Arippe on the northern coast. The season of the fishery lasts about three months, commencing at the beginning of February, and is carried on under government regulations. The boats employed are open, and vary in size from ten to fifteen tons burden; they put out at night, usually at ten o'clock, on a signal gun being fired from the fort of Arippe, and make for the government guard vessel, which is moored on the bank, and serves the double purpose of a guard and a light-ship. The divers are under the direction of a manager, who is called the Adapanaar, and they are chiefly Tamils and Moors from India. For each diver there is provided a diving stone, weighing about thirty pounds, which is fastened to the end of a rope long enough to reach the bottom, and having a loop made for the man's foot; and in addition to this, a large network basket, in which to place the pearloysters as he collects them. These are hung over the sides of the boat; and the diver, placing his foot in the loop attached to the stone, liberates the coils of the rope, and with his net-basket rapidly descends to the bottom. To each boat there is usually allotted a crew of thirteen men and ten divers, five of whom are descending while the others are resting. This work is done very rapidly; for, notwithstanding the stories to the contrary, the best divers cannot remain longer than eighty seconds below, and few are able to exceed sixty. The greatest depth they descend is thirteen fathoms, and the usual depth about nine fathoms. When the diver gives the signal by pulling the rope, he is quickly hauled up with his net and its contents. Accidents rarely happen; and as the men are very superstitious, their safety is attributed to the incantations of their shark-charmers, performed at the commencement of the fishing. Sir E. Tennent, however, attributes the rarity of accidents from sharks, usually so abundant in tropical seas, to the bustle and to the excitement of the waters during the fishery frightening away those dreaded creatures. The divers are sometimes paid fixed wages, others agree for one-fourth of the produce. When

a boat-load of oysters has been obtained, it returns to shore, and the cargo, sometimes amounting to twenty or thirty thousand, is landed and piled on the shore to die and putrefy, in order that the pearls may be easily found. The heaps are formed in small walled compartments, the walls surrounding each being one or two feet in height. Several of these compartments surround a small central enclosure, in which is a bath, and they slope towards this bath, and are each connected with it by a small channel, so that any pearls washed out from the putrefying mass by the rain may be carried into the bath. When the animals in the shells are sufficiently decomposed, the washing commences, and great care is taken to watch for the loose pearls, which are always by far the most valuable; the shells are then examined, and if any attached pearls are seen, they are handed over to the clippers, who, with pinchers or hammer, skillfully remove them. Such pearls are used only for setting; whilst the former, being usually quite round, are drilled and strung, and can be used for beads, etc. The workmen who are employed to drill the pearls also round the irregular ones, and polish them with great skill. The method of holding the pearls during these operations is very curious; they make a number of holes of small depth in a piece of dry wood, and into these they fit the pearls, so that they are only partly below the surface of the wood, which they then place in water. As it soaks up the water and swells, the pearls become tightly fixed, and are then perforated, etc. These operations are all carried on on the spot.

For many miles along the Condatchy shore, the accumulation of shells is enormous, and averages at least four feet in thickness. This is not to be wondered at, when it is remembered that this fishery has been in active operation for at least two thousand years. The place itself is exceedingly barren and dreary, and, except during the fishing season, is almost deserted; but at that time it presents an exceedingly animated spectacle; thousands of people, of various countries and castes, are here drawn together—some for the fishery, others to buy pearls, and others to feed the multitude. They chiefly reside in tents, so that it appears a vast encampment.

The pearls vary much in size; those as large as a pea, and of good color and form are the best, except unusually large specimens, which rarely occur, the most extraordinary one known being the pearl owned by the late Mr. Hope, which measured two inches in length and four in circumference, and weighed eighteen hundred grains. The smaller ones are sorted into sizes, the very smallest being called seed-pearls. A considerable quantity of these last are sent to China, where they are said to be calcined, and used in Chinese pharmacy. Among the Romans, the pearl was a great favorite, and enormous prices were paid for fine ones. One author gives the value of a string of pearls at one million sesterces, or about \$40,000. The single pearl which Cleopatra is said to have dissolved and swallowed was valued at \$400,000; and one of the same value was cut into two pieces for earrings for the statue of Venus in the Pantheon at Rome. Coming down to later times, we read of a pearl, in Queen Elizabeth's reign, belonging to Sir Thomas Gresham, which was valued at \$75,000, and which he is said to have treated after the fashion of Cleopatra, for he powdered it and drank it in a glass of wine to the health of the Queen, in order to astonish the ambassador of Spain, with whom he had laid a wager that he would give a more costly dinner than could the Spaniard.

Sponges.—While handling sponge in its prepared state, as we see it in the shops, it is difficult to believe that it belongs to the animal kingdom.

Sponge, however, is not the animal itself, but only its skeleton, or framework, as it were. That which constitutes the living portion of the animal is removed in preparing the sponge for market. The animal proper covers the framework, and is of a jelly-like appearance, like that of other low forms of animal life. Various openings and channels allow the passage of water through all parts of the mass, and the gelatinous portion has microscopic hairs, which are capable of rapid motion, and by their means water is drawn into and forced out of the sponge. When divided, the living sponge seems to suffer no inconvenience, but each part sets up on its own account, lives on as if nothing had happened, and it becomes two sponges.

The best sponge of commerce is found in the Mediterranean, and is known as Turkey or Smyrna sponge; this is obtained by divers. Bahama



A LIVING SPONGE.

or West India sponge is coarser, and is sold at a much less price. Much sponge is gathered off the coast of Southern Florida. Indeed, the Florida sponge fisheries furnish employment to many men and boats.

When a vessel arrives at the fishing ground in the Bahama Islands, it is anchored, and the men in small boats proceed to look for sponges in the water below. The water is a beautiful light-blue color, and so clear a sixpence can easily be seen on the white sandy bottom in thirty-five to forty feet of water. Of course when there is no wind, and the surface of the water is still, the sponges are easily seen, but when a gentle breeze is blowing a "sea-glass" is used. A sea-glass consists of a square pine box about twenty inches in length, a pane of glass about ten by twelve inches placed

in one end, water-tight. To use it, the glass end is thrust into the water, and the face of the operator is placed close to the other. By this means the wave motions of the water are overcome, and the bottom readily seen. Sponges when seen on the bottom attached to the rocks, look like a big black bunch. They are pulled off their natural beds by forked hooks, which are run down under the sponge, which is formed like the head of a cabbage, and the roots pulled from the rocks.

When brought to the surface it is a mass of soft, glutinous stuff, which to the touch feels like soap or thick jelly. When a small boat load is obtained they are taken to the shore, where a crawl is built in which they are placed to die, so that the jelly substance will readily separate from the firm fibre of the sponge. These crawls are built by sticking pieces of brush into the sand out of the water, large enough to contain the catch. It takes from five to six days for the insect to die, when the sponges are beaten with small sticks, and the black glutinous substance falls off, leaving the sponge, after a thorough washing, ready for market.

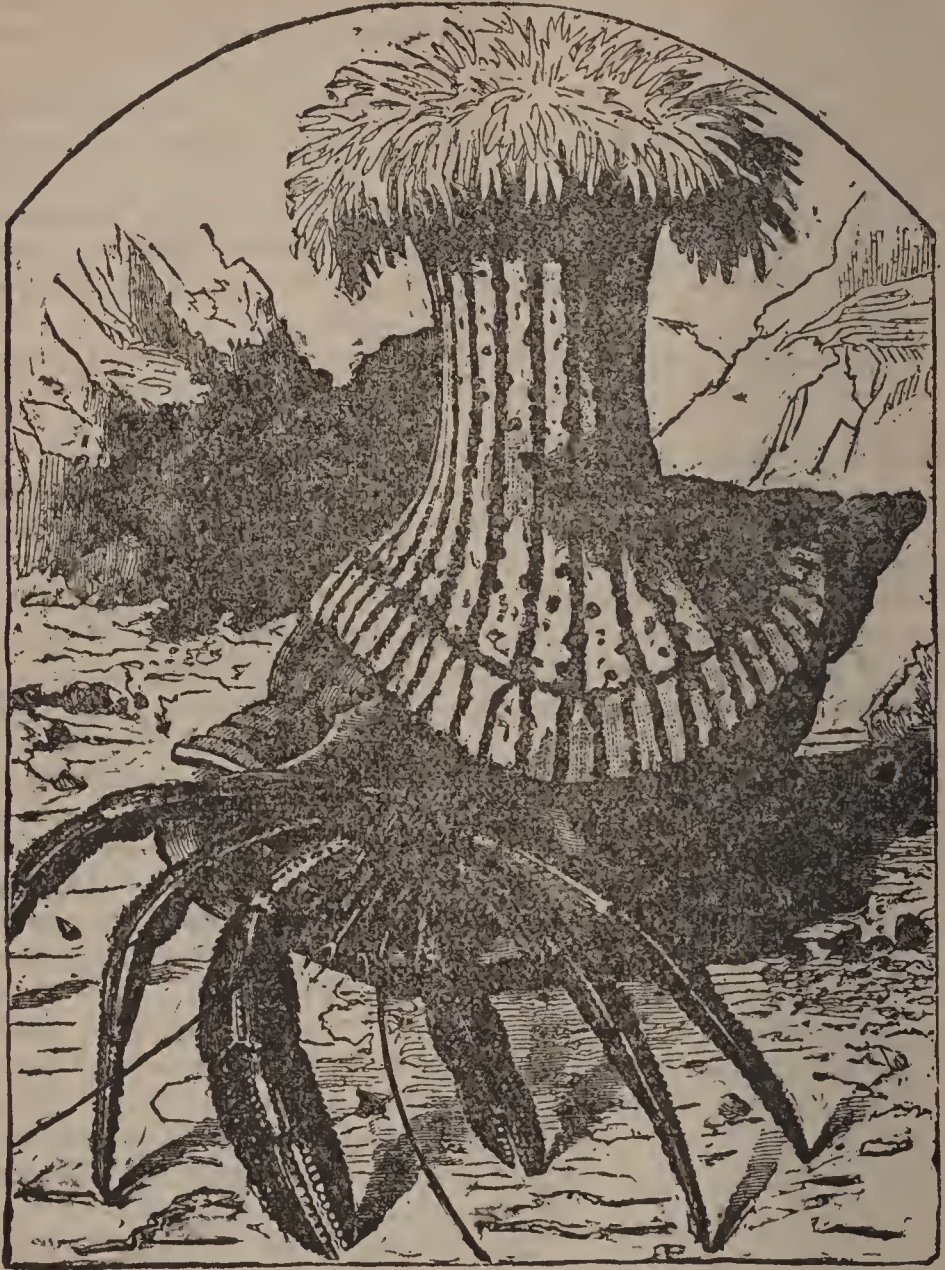
The "Conch Pearl."—Many people, says the *Scientific American*, have doubtless frequently seen and admired the delicately tinted, pink-faced shells which are extensively used in the United States for bordering garden walks and other ornamental purposes, but few probably are aware that in the conch which forms and inhabits this shell is occasionally found a very lovely gem, known to lapidaries as the conch pearl. When perfect, the pearl is either round or egg-shaped and somewhat larger than a pea, of a beautiful rose-color, and watered—that is, presenting, when held to the light, the sheeny, wavy appearance of watered silk. It is, however, a very rare circumstance to find a pearl which possesses all the requirements that constitute a perfect gem, and when such does happen, it proves an exceedingly valuable prize to its fortunate finder. A good pearl is very valuable indeed, some having been sold in Nassau for no less a sum than four hundred dollars. Although many of these pearls are annually obtained by the fishermen in the Bahamas, not more than one in twenty proves to be a really good gem, and hence probably their high price.

Pink is the most common and only desirable color, although white, yellow and brown pearls are occasionally found. Even among the pink ones there is usually some defect which mars their beauty and materially injures them; some are very irregular in shape, and covered, apparently, with knobs or protuberances; others are too small, while many lack the watering which gives them their great value and chief beauty.

The conch abounds in the waters of the Bahamas, and thousands of them are annually obtained and destroyed for their shells, which form quite an article of commerce, but in not one conch in a thousand is a pearl found. When this is taken into account, and the other fact, that not more than one in twenty of pearls found turns out to be perfect, it will at once be seen that a good conch pearl will always be a rare and costly gem. In fact, their value within the last few years has almost doubled, and the demand for them is steadily increasing.

A Sea Aster Attached to a Crab.—The species of sea aster oftenest found on the coast of New Jersey and northward, though not among the most attractive, is nevertheless a very interesting specimen. He is generally of a dingy or creamy white, striped and dotted with a rich brown, and above all crowned with an abundant spread of pink and white feathery ten-

tacles. Unlike most of his race, he does not delight in solitary and local position, and so seems to have caught the spirit of his native land, and seeks for new scenes; and, not to be behind his biped neighbors, he prefers that others should give him a free ticket for all his journeys. He glues himself



A SEA ASTER ATTACHED TO A CRAB.

to the shell of some crab or periwinkle, and takes a gratuitous ride to any place where it may feel disposed to carry him.

The Floor of the Ocean.—Here is an end of all romance about hidden ocean depths. We can speculate no longer about peris in chambers of pearl, or mermaids, or heaped treasures and dead men's bones whitening in coral caves. The whole ocean floor is now mapped out for us. The report of the expedition sent out from London in Her Majesty's ship "Challenger" has recently been published. Nearly four years were given to the examination of the currents and floors of the four great oceans of the world.

The Atlantic, we are told, if drained, would be a vast plain, with a mountain range in the middle running parallel with our coast. Another range crosses it from Newfoundland to Ireland, on top of which lies a submarine cable. The ocean is thus divided into three great basins, no longer "unfathomable depths."

The tops of these sea mountains are two miles below a sailing ship, and the basins, according to Reenius, are fifteen miles, which is deep enough for drowning, if not for mystery.

The mountains are whitened for thousands of miles by a tiny creamy shell. The depths are red in color, heaped with volcanic masses. Through the black, motionless water of these abysses move gigantic abnormal creatures, which never rise to upper currents.

There is an old legend coming down to us from the first ages of the world on which these scientific Dead Sea soundings throw a curious light. Plato and Solon record the tradition, ancient in their days, of a country in the western seas where flourished the first civilization of mankind, which, by volcanic action, was submerged and lost. The same story is told by the Central Americans, who still celebrate, in the fast of Izcalli, the frightful cataclysm which destroyed this land with its stately cities.

De Bourbrough and other archæologists assert that this land extended from Mexico beyond the West Indies. The shape of the plateau discovered by the "Challenger" corresponds with this theory. What if some keen Yankee should yet dredge out from its unfathomed slime the lost Atlantis?

At the Bottom of the Indian Ocean.—Who can tell of all the wondrous things that live in the sea? In the Indian Ocean, many feet below the surface of the water, grow woods quite as luxuriant as any jungles or thickets we read of in South America. Some of the trees grow as high as two houses piled on one another. They are called by a hard name—"Nerocysten." The roots resemble coral, and from the slender stem grows a cluster of very long leaves. Other trees grow almost as high, and end in one single huge leaf that is about the size of our forest trees. Bushes—green, yellow and red—are dotted here and there, and a velvety carpet of diminutive plants covers the ground. Flowers in all the tints of the rainbow ornament the rocks, and large leaves of the iris, of dazzling pink and red, float among them, and sea-anemones, as large and brilliant as cactus-flowers, form beds in the moss. Blue, red, purple and green little fish dart here and there, and between the bushes glides like a serpent the long silvery ribbon fish. Thus beautiful it is in the day; but when night comes on, and you suppose all creatures gone to bed, the landscape grows more lovely still. Little crabs and medusas light up the sea; the sea-pen quivers with green phosphoric light; what was brown and red in the day is changed into bright green, yellow and red; and among all these glittering jewels the moonfish floats like a silvery crescent.

A Murderous Sea Flower.—One of the exquisite wonders of the sea is called the opelet, and is about as large as the German aster, looking, indeed, very much like one. Imagine a very large double aster, with a great many long petals of a light green color, glossy satin, and each one tipped with rose color. These lovely petals do not lie quietly in their places, but wave about in the water, while the opelet clings to the rock. How innocent and lovely it looks on its rocky bed! Who should suspect that it would eat anything grosser than dew and sunlight? But those

beautiful waving arms, as you call them, have uses besides looking pretty. They have to provide for a large, open mouth, which is hidden down deep among them—so hidden that one can scarcely find it. Well do they perform their duty, for the instant a foolish little fish touches one of the rosy tips, he is struck with poison as fatal to him as lightning. He immediately becomes numb, and in a moment stops struggling, and then the other arms wrap themselves around him, and he is drawn into the huge, greedy mouth, and is seen no more. Then the lovely arms uncloze, and wave again in the water.

A Singular Star Fish.—The most singular of all the star fishes is the splendid *Astrophyton*. Its center is not unlike the gorgeous appear-



A SINGULAR STAR FISH.

ance of a Chinese wheel; but what a curious tie of twisting and twining tentacles. From the central disc five stout arms branch out, which are subdivided at once, and these again in turn; and so on continuously until more than eighty thousand branches are formed, puzzling the eye to search out the mass of ramifications. All these tentacles are extremely flexible, and are generally kept wreathing and twisting; but when the animal chooses, they can be so closely drawn up as to give the shape of a globular basket; hence the creature is often called by the fishermen the "Sea Basket." By stretching out this mass of long tentacles, the animal forms a large net, by means of which it effects its captures and holds the victim to its mouth.

FAMILIAR SCIENCE.

The Earth.—To a spectator so placed as to have an unobstructed view all round, the earth appears a circular plain, on whose circumference the vault of heaven seems to rest. Accordingly, in ancient times, even philosophers long looked upon the earth as a flat disc swimming upon the water. But many appearances were soon observed to be at variance with this idea; and even in antiquity, the spherical form of the earth began to be suspected by individuals. It is only by assuming the earth to be spherical, that we can explain how our circle of vision becomes wider as our position is more elevated; and how the tops of towers, mountains, masts of ships, and the like come first into view as we approach them. There are many other proofs that the earth is a globe. Thus, as we advance from the poles towards the equator, new stars, formerly invisible, come gradually into view; the shadow of the earth upon the moon during an eclipse is always round; the same momentary appearance in the heavens is seen at different hours of the day in different places on the earth's surface; and lastly, the earth, since 1519, has been circumnavigated innumerable times. The objection to this view that readily arises from our unthinking impressions of up and down, which immediately suggests the picture of the inhabitants of the opposite side of the earth—our *antipodes*—with their heads downwards, is easily got over by considering that on all parts of the earth's surface, down is towards the earth's center.

It is not, however, strictly true that the earth is a sphere; it is slightly flattened or compressed at two opposite points—the poles—as has been proved by actual measurement of degrees of latitude, and by observations of the pendulum. It is found that a degree of a meridian is not everywhere of the same length as it would be if the earth were a perfect sphere, but increases from the equator to the poles; from which it is rightly inferred that the earth is flattened there. A pendulum, again, of a given length is found to move faster when carried towards the poles, and slower when carried towards the equator, which shows that the force of gravity is less at the equator than at the poles, or, in other words, that the center, the seat of gravity, is more distant at the former than at the latter. The diminished force of gravity at the equator has, it is true, another cause, namely, the centrifugal force arising from the rotation of the earth, which acts counter to gravitation, and is necessarily greatest at the equator, and gradually lessens as we move northwards or southwards, till at the poles it is nothing. But the diminution of the force of gravity at the equator arising from the centrifugal force amounts to only 1-289 of the whole force: while the diminution indicated by the pendulum is 1-194. The difference, or 1-580 nearly, remains assignable to the greater distance of the surface from the center at the equator than at the poles.

We have now seen that the earth is a sphere slightly flattened at its poles—what is called by geometers an elliptical spheroid—of a mean radius of somewhat less than four thousand miles. We have next to consider its

mass and density. Nothing astonishes the young student more than the idea of weighing the earth; but there are several ways of doing it; and unless we could do it, we never could know its density. (1.) The first method is by observing how much the attraction of a mountain deflects a plummet from the vertical line. This being observed, if we can ascertain the actual weight of the mountain, we can calculate that of the earth. In this way, Dr. Maskelyne, in the years 1774-1776, by experiments at Schihallion, in Perthshire, a large mountain mass lying east and west, and steep on both sides—calculated the earth's mean density to be five times greater than that of water. The observed deflection of the plummet in these experiments was between 4" to 5". (2.) In the method just described, there must always be uncertainty, however accurate the observations, in regard to the mass or weight of the mountain. The method known as *Cavendish's experiment* is much freer from liability to error. This experiment was first made by Henry Cavendish on the suggestion of Michell, and has since been repeated by Reich of Freyberg, and Mr. Francis Baily. The apparatus used by Mr. Baily has two small balls at the extremities of a fine rod suspended by a wire, and their position carefully observed by the aid of a telescope. Large balls of lead, placed on a turning-frame, are then brought near them in such a way that they can affect them only by the force of their attraction. On the large balls being so placed, the small ones move towards them through a small space, which is carefully measured. The position of the large balls is then reversed, and the change of position of the small balls is again observed. Many observations are made, till the exact amount of the deviation of the small balls is ascertained beyond doubt. Then by calculation the amount of attraction of the large balls to produce this deviation is easily obtained. Having reached this, the next question is, what would their attraction be if they were as large as the earth? This is easily answered, and hence, as we know the attractive force of the earth, we can at once compare its mean density with that of lead. Mr. Baily's experiments lead to the result that the earth's mean density is 5.07 times that of water. (3.) A third mode has lately been adopted by the Astronomer-royal, by comparison of two invariable pendulums, one at the earth's surface, the other at the bottom of a pit at Harton Colliery, near Newcastle, one thousand two hundred and fifty feet below the surface. The density of the earth, as ascertained from this experiment, is between six and seven times that of water; but for various reasons this result is not to be accepted as against that of the Cavendish experiment, and it is said that the Astronomer-royal was himself dissatisfied with it, and meant to repeat the experiment with new precautions. The density of the earth being known, its mass is easily calculated, and made a unit of mass for measuring that of the other bodies in the system. It is found that the mass of the earth compared with that of the sun is .000028173.

The earth, as a member of the solar system, moves along with the other planets round the sun from west to east. This is contrary to our sensible impressions, according to which the sun seems to move round the earth; and it was not till a few centuries ago that men were able to get over this illusion. This journey round the sun is performed in about three hundred and sixty-five and a quarter days, which we call a year (solar year). The earth's path or orbit is not strictly a circle, but an ellipse of small eccentricity, in one of the foci of which is the sun. It follows that the earth is not equally distant from the sun at all times of the year; it is nearest, or in perihelion, at the beginning of the year, or when the northern hemisphere has

winter; and at its greatest distance, or aphelion, about the middle of the year, or during the summer of the northern hemisphere. The difference of distance, however, is comparatively too small to exercise any perceptible influence on the heat derived from the sun, and the variation of the seasons has a quite different cause. The least distance of the sun from the earth is over ninety-four millions of miles, and the greatest over ninety-six millions; the mean distance is commonly stated at ninety-five millions. If the mean distance be taken as unity, then the greatest and least are respectively represented by 1.01679, and 0.98321. It follows that the earth yearly describes a path of upwards of five hundred and ninety-six millions of miles, so that its velocity in its orbit is about ninety-nine thousand feet, or nineteen miles in a second.

Besides its annual motion round the sun the earth has a daily motion or rotation on its axis, or shorter diameter, which is performed from west to east, and occupies exactly twenty-three hours, fifty-six minutes, four seconds of mean time. On this motion depend the rising and setting of the sun, or the vicissitudes of day and night. The relative lengths of day and night depend upon the angle formed by the earth's axis with the plane of its orbit. If the axis were perpendicular to the plane of the orbit, day and night would be equal during the whole year over all the earth, and there would be no change of seasons; but the axis makes with the orbit an angle of $23\frac{1}{2}^{\circ}$, and the consequence of this is all that variety of seasons and of climates that we find on the earth's surface; for it is only for a small strip (theoretically, for a mere line) lying under the equator that the days and nights are equal all the year; at all other places, this equality only occurs on the two days in each year when the sun seems to pass through the celestial equator, i. e., about the 21st of March and 23d of September. From March 21, the sun departs from the equator towards the north, till, about June 21, he has reached a north declination of $23\frac{1}{2}^{\circ}$, when he again approaches the equator, which he reaches about September 23. He then advances southward, and about December 21 has reached a south declination of $23\frac{1}{2}^{\circ}$, when he turns once more towards the equator, at which he arrives March 21. The 21st of June is the longest day in the northern hemisphere, and the shortest in the southern; with the 21st of December it is the reverse.

The velocity of the earth's rotation on its axis evidently increases gradually from the poles to the equator, where it is about equal to that of a musket-ball, being at the rate of twenty-four thousand eight hundred and forty miles a day, or about one thousand four hundred and forty feet in a second.

A direct proof of the rotation of the earth is furnished by its compression at the poles. There are indubitable indications that the earth was originally fluid, or at least soft; and in that condition it must have assumed the spherical shape. The only cause, then, that can be assigned for the fact that it has not done so, is its rotation on its axis. Calculation also shows that the amount of compression which the earth actually has, corresponds exactly to what its known velocity and mass must have produced. Experiments with the pendulum, too, show a decrease of the force of gravity from the poles toward the equator; and though a part of this decrease is owing to the want of perfect sphericity, the greatest part arises from the centrifugal force caused by the motion of rotation. Another direct proof of the same hypothesis may be drawn from the observation, that bodies dropped from a considerable height deviate towards the east from the vertical line,

This fact has been established by the experiments of Benzenberg and others. In former times, it was believed that if the earth actually revolved in the direction of the east, a stone dropped from the top of a tower would fall, not exactly at the foot of the tower, but to the west of it. Now, as experience, it was argued, shows that this is not the case—that the stone, in fact, does fall at the bottom—we have here a proof that the pretended rotation of the earth does not take place. Even Tycho Brahe and Riccioli held this objection to the doctrine to be unanswerable. But the facts of the case were just the reverse. Newton, with his wonted clearness of vision, saw that, in consequence of the earth's motion from west to east, bodies descending from a height must decline from the perpendicular, not westward, but eastward; since, by their greater distance from the earth's center, they acquire at the top a greater eastward velocity than the surface of the earth has at the bottom, and retain that velocity during their descent. He therefore proposed that more exact observations should be made to ascertain the fact; but it was not till more than a century afterwards that experiments of sufficient delicacy were made to bring out the expected result satisfactorily. It is difficult to find an elevation sufficiently great for the purpose, as several hundred feet give merely a slight deviation, which it requires great accuracy to observe. If a height of ten thousand feet could be made available, the deviation would be not less than seven and one-half feet. The analogy of our earth to the other planets may also be adduced, the rotation of which, with the exception of the smallest and the most distant, is distinctly discernible. Finally, an additional proof of the earth's rotation was lately given by Leon Foucault's striking experiment with the pendulum. The principle of the experiment is this: That a pendulum once set in motion, and swinging freely, continues to swing in the same plane, while at any place at a distance from the equator the plane of the meridian continues to change its position relative to this fixed plane. The objection taken to the doctrine of rotation from the fact that we are unconscious of any motion, has little weight. The movement of a vessel in smooth water is not felt, though far less uniform than that of the earth; and as the atmosphere accompanies the earth in its motion, there is no feeling of cutting through it to break the illusion of rest.

If the turning of the earth on its axis is thus proved to be the cause of the apparent daily motion of the heavens, it is an easy step to consider the annual motion of the sun through the constellations of the zodiac as also apparent, and arising from a revolution of the earth about the sun in the same direction of west to east. If we consider that the mass of the sun is about three hundred and fifty-nine thousand times greater than that of the earth, and that by the laws of mechanics, two bodies that revolve round each other, must revolve about their common center of gravity, the idea of the sun revolving about the earth is seen to be simply impossible. The common center of gravity of the two bodies being distant from the center of each inversely as their respective masses, is calculated to be only two hundred and sixty-seven miles from the center of the sun, and therefore far within his body, which has a diameter of eight hundred and eighty-two thousand miles. But by help of a figure, it is easy to show that the apparent motion of the sun on the ecliptic naturally arises from a motion of the earth about the sun. The motions of the planets also, that appear so complicated and irregular as seen by us, can only be satisfactorily explained by assuming that they too revolve round the sun in the same direction as the earth.

That the interior of the earth is the seat of intense heat is a familiar

truth. Volcanic phenomena give us ocular demonstration of it. Mining experiences, moreover, have furnished us with an almost uniform rate at which the heat increases, and this is generally computed to be about one degree Fahrenheit for every fifty-five feet of descent. But mining experiences are necessarily very limited. The deepest mine in England, that of the Rosebridge colliery, near Wigan, takes us down only two thousand four hundred and forty-five feet, and to a temperature not much exceeding ninety degrees Fahrenheit. It is hot enough to make the work exceedingly trying to the miners, but that is all. This, however, is (so to speak) scarcely traversing the earth's epidermis. But if we may assume a uniform increase of heat in descending, the temperature at a depth of fifty miles may be expressed in figures as four thousand eight hundred degrees Fahrenheit. In other words, at less than an eighth of the distance which lies between the circumference of the earth and its center, the heat would be about twenty-two times the heat of boiling water at the sea level. Proportionate figures might, of course, express the heat at greater depths still, but figures fail to convey any idea to the mind of that which must necessarily transcend all imagination. Suffice it to say, that in a descending series we must eventually come to a heat so great that no substance with which we are acquainted could, under any conditions which we can imagine, exist in it in either solid or fluid form. And we conclude, therefore, that if the earth's center be not itself in a gaseous condition (and there is reason to think that it may not be so) there must be a gaseous zone somewhere between a solid center and a solid circumference. "*Facilis descensus Averni*" is proverbially treated as a truism. But if the classic authors are to be our guides, and if in the center of our planet Acherontian Shades and Elysian Fields are to be localized, there will be found practical difficulties of access which might well discourage even so substantial a personage as a ghost. Nor can the all-powerful imagination accomplish the descent with any approach to ease. The distance we may suppose to be nearly four thousand three hundred miles; but along a line of this length connecting the surface of the earth with its center, we may safely assume that conditions would vary greatly, and (since heat and pressure have to be balanced one against the other) probably by no means uniformly. We can measure the power of pressure upon the surface, but in the nether depths its power is in part open to conjecture, nor can we say how soon we may reach a debatable zone, at which the expansiveness of heat may overcome the compressive force of gravitation. Nor, again, could we venture to expect to find that zone itself always at a uniform depth. Here and there it seems to approach the surface. The volcano is nature's safety-valve, and the cavernous rumbles of the earthquake warn us that there are imprisoned gases beneath our feet, which pressure but imperfectly prevents from escaping. Upon other grounds, also, it is quite evident that our experience, limited as it is to the surface of the earth, may tend to mislead us in regard to what lies beneath the surface; for, if pressure increased uniformly with depth, the average density of the earth would be much greater than what, upon astronomical data, we know it to be. The earth as a whole, is about five and a half times as heavy as it would be if it were entirely composed of water; or, technically expressed, the density of water is one, and the mean density of the globe is five and a half. But five and a half is only about double the density of rock matter upon the surface; whereas, if nothing but steadily increasing pressure be supposed, it would vastly exceed this. There is, therefore, only one possible explanation. Heat, intense heat, somewhere or other, overcomes pres-

sure and converts everything into gas; and if it were in our power to try experiments, and to feed the subterranean crucible with the most intractable substance—asbestos, fire-proof safes, or what we will—all would there share the same fate—instant evanescence.

The Sun.—The following interesting information regarding the sun is from the stenographic report of a lecture by Professor Garrett P. Serviss, secretary of the American Astronomical Society: “No one present probably knows how grand a planet the sun is. Its size cannot be conceived. But let us weigh it and get some idea of its great dimensions. Put the sun and earth in the scales and add the planet Jupiter to the latter and the sun would weigh more, and yet Jupiter weighs three times as much as all the other planets put together. We will then throw all the other planets in the scale with the earth and yet the sun will not move. Aladdin’s wonderful lamp would not make the sun budge. Don’t let us give it up, however, but throw in one hundred thousand globes and then altogether we will have three hundred thousand globes, but still the sun would not budge. We’ll add thirty thousand more worlds and the sun then moves until it just balances the enormous weight of three hundred and thirty thousand worlds. By this it will be seen that the attractive power of the sun must be very great to keep such an enormous mass in control. The earth weighs six sextillions of tons. If a man possessed the same number of dollars and began counting them out at the rate of ten dollars a minute, the time which would have elapsed since the time of Adam and Eve, nearly six thousand years, would be a mere incident in comparison to the period during which the calculation would have to continue. The weight of the earth is so great that it is flying through the air only controlled by the laws of gravitation. The velocity of this globe is so great that it goes through space at the rate of eighteen miles a second. The distance of the sun from the earth is estimated at about ninety-five million miles, and yet it is held secure by the resistless arms of gravitation. The earth cannot get away, for the sun holds it in its power. Look at Jupiter, the gigantic; it is fifteen times larger than the earth, and yet the sun holds Jupiter. The planets are the slaves of the sun, which by the wonderful power of gravitation holds everything in the power of the great orbit. The sun is the source of all life, and the heat from it is so great that we are able to live only on account of it. If the sun was to lose its heat for one month the earth would die. During the past three years the surface of the sun has been covered with spots, commonly called “sun spots.” They have been so large in some instances that they have been seen without the aid of a telescope. Some of these spots are larger than the earth. They appear on the surface like holes into which streams of molten metal seemed to continually pour. The sun is simply a ball of gases, and the matter found in it is composed of iron, gold and silver, copper and granite. Indeed these substances are so great that they would make three hundred thousand globes like that in which we live and work. The spots are like vapors, which appear and disappear at times. Last year the sun was full of these spots. It has been noticed that they appear about once in every eleven years. The cavity is so enormous in some of the spots that the earth could be dropped into it and disappear like a billiard ball. On the 16th of April, 1882, the lecturer watched these spots, and he found the surface of the great body change in a most wonderful manner. They gave a terror to the scene. Just as the sun disappeared below the horizon it was noticed that a pale green arch of light appeared above the horizon.

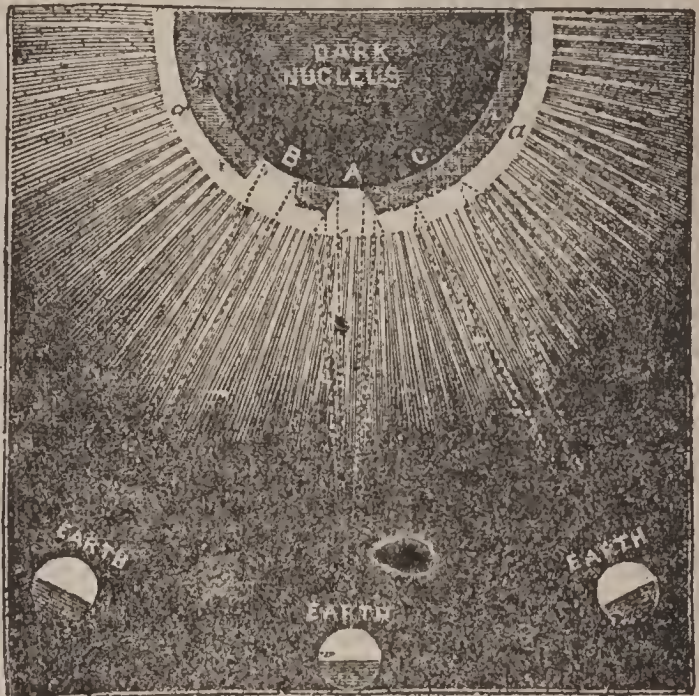
just over the point where the sun had gone down. This was followed in time by bright streams of light shooting up to the zenith, after which the aurora borealis was visible in the sky. There was no sound, and the flaming heavens were as silent as death. It was a pantomime played by ghosts of fire. The lecturer then referred to the corona of the sun. It appeared to be a shell of scarlet fire, and was only to be seen at a total eclipse; but it had lately been seen by aid of powerful telescopes in the daylight. The sun is a globe of matter heated to a gaseous condition. The sheet of scarlet fire is supposed to have been caused by long ago and constant eruptions, sending up showers of red flames and heat from the inside of the sun. The sun will doubtless die in the course of the next ten million years. We will wait till that time and see what happens. It is now going through a process of cooling. All life would cease throughout the solar system and the earth would be lighted only by the stars. At present an envelope or crust is being seen on the edge of the great orbit of day. This will in time cover the entire surface, and then the radiant splendors of the sun will be invisible."

Herschel's Theory of Sun Spots.

Sun spots.—Sun spots consist of a black center or nucleus called the *umbra*, and a grayish envelope or border called the *penumbra*. These again are surrounded by bright streaks or patches of light called *faculae*. But they vary in appearance. Sometimes the nucleus is seen without a penumbra, and again it is not seen at all. They constantly change in size, position and number. Some come and go in a day, while others

last weeks without much change. The generally received opinion seems to be that the sun is an opaque body, surrounded by three cloud-like envelopes, each several thousand miles in thickness. The one nearest the sun is a cloudy atmosphere, reflecting light, but giving out none. The second, called the photosphere, is luminous, and the source of the sun's light. The third is transparent, and surrounds the other. Sun spots are supposed to be openings or rifts in these different envelopes. The openings are supposed by Sir John Herschel to be caused by changes of temperature, like those which produce our whirlwinds. Another interesting fact is that when there are most sun spots the beautiful aurora borealis is most frequently seen.

The Moon.—The moon is the satellite of the earth, around which it revolves from west to east in a period of one month, and in consequence



HERSCHEL'S THEORY OF SUN SPOTS.

a a, the photosphere; *b b*, the cloud envelope; *A*, spot with nucleus and penumbra; *B*, spots without penumbra; *C*, penumbra without nucleus.

accompanying the earth in its motion round the sun. As the moon, to an observer on the earth, advances more than 13° to the east daily, whilst the corresponding advance of the sun is barely 1° , her progress among the stars is much more notable than that of the latter. This rapid angular motion, the continual and regular variation of her illuminated surface, and her large apparent size (being nearly equal to that of the sun), have rendered the moon an object of general interest; while her importance as the principal nocturnal substitute for the sun, and her special value to navigators and geographers in the determination of longitudes, have rendered the *lunar theory* the object of the most thorough and careful investigation.

The first peculiarity about the moon that strikes a casual observer, is the constant and regular change of her illuminated surface from a thin crescent to a circle, and *vice versa*, and a corresponding change in the time of her appearance above the horizon. These changes depend upon the position of the moon relative to the earth and the sun, for it is only the half of the moon facing the sun that is illuminated by his rays, and the whole of this illuminated portion can only be seen from the earth when the sun, earth and moon are in a straight line (*the line of syzygies*), and the earth is between the sun and moon. When the moon is in the line of syzygies, but between the earth and the sun, no part of her illuminated disc can be seen from the earth. In the former case, the moon is said to be *full*, and in the latter, *new*. A few hours after "new moon," the moon appears a little to the *east* of the sun as a thin crescent, with the horns pointing towards the *east*, and as she increases her angular distance from the sun at the rate of about 12° daily, the crescent of light becomes broader, till, after the lapse of a little more than seven days, at which time she is 90° in advance of the sun, she presents the appearance of a semi-circle of light. The moon is then said to have completed her *first quarter*. Continuing her course, she becomes "gibbous;" and at the fifteenth or sixteenth day from new moon, attains a position 180° in advance of the sun, and now presents the appearance known as *full moon*. From this point she begins to approach the sun, again appearing gibbous, and after a third period of more than seven days, reaches a point 90° west of him, and enters her *last quarter*. Here, again, she appears as a semi-circle of light, the illuminated portion being that which was not illuminated at the end of the first quarter. The moon now rapidly approaching the sun, resumes the crescent form, but this time with the horns pointing *westward*, the crescent becoming thinner and thinner, till the moon reaches the position of new moon, and disappears. From "full moon" to "new moon," the moon is said to be *waning*; and from "new moon" to "full moon," *waxing*. The earth as seen from the moon presents similar phases, and has, consequently, at the time of new moon, the appearance of a round illuminated disc, and at full moon, is invisible. This explains the peculiar phenomenon occasionally observed when the moon is near the sun (either before or after new moon), of the part of the moon's face which is unilluminated by the sun appearing faintly visible, owing to the reflection upon it of strong earth-light. This phenomenon is designated by the Scottish peasantry as "the new mune wi' the auld mune in her arms." At new moon the moon of course comes above the horizon about the same time as the sun, and sets with him, but rises each day about fifty minutes later than on the day previous, and at the end of the first quarter, rises at midday, and sets at midnight, continuing to lag behind the sun. When at the full, she rises about sunset, and sets about sunrise, and at the commencement of her last quarter, she rises at midnight and sets at mid-

day. From repeated observations of the moon's horizontal *parallax*, and of the occultation by her of the fixed stars, her mean distance from the earth has been estimated at 237,600 miles, and as her angular diameter averages $31' 26''$, her actual diameter is 2,153 miles, or a little less than $\frac{3}{11}$ ths of the earth's diameter. Her volume is therefore about $\frac{1}{19}$ th of that of the earth, and her density being only $\cdot 577$ (that of the earth being taken as unity), her mass is only $\frac{1}{88}$ th of the earth's mass; consequently, the force of gravity at her surface is so much less than it is at the surface of the earth, that a body which weighs one thousand pounds here, would at the moon weigh only one hundred and sixty-three pounds.

The moon revolves round the earth in an elliptic orbit, with the earth in the focus; the eccentricity of the ellipse being equal to $\cdot 05491$ of half its major axis, or more than three and one-quarter times that of the earth's orbit. The plane of her orbit does not coincide with the ecliptic, but is inclined to it at an angle of $5^{\circ} 8' 47\cdot 9''$, and intersects it in two opposite points, which are called the *Nodes*. The point at which the moon is nearest to the earth is called her *perigee*, and that at which she is farthest from it her *apogee*, and the line joining these two points is called the *line of apsides*. Were the moon's orbit a true ellipse, which, owing to various irregularities known as *perturbations*, it is not, the *lunar theory* would be exceedingly simple; but these perturbations, which, in the case of the planets, produce a sensible variation in their orbit only after many revolutions, cause, in the case of the moon, a distinct and well-marked deviation from her previous course in a single revolution. The retrogradation of her nodes along the ecliptic causes a continual change in the plane of her orbit, so that if, during one revolution round the earth, she occults certain stars, at the next revolution she will pass to one side of them, and will remove farther and farther from them in each successive revolution. A little consideration will show that by this continual change of her orbit, the moon will, in course of time, pass over or occult every star situated within $5^{\circ} 24' 30''$ of the ecliptic. The motion of the nodes is so rapid that they perform a complete circuit of the orbit in $6793\cdot 39$ mean solar days, or $18\cdot 6$ years. Another important change in the moon's orbit is the revolution of the line of apsides, by which the perigee and apogee are continually changing their position relative to the earth and sun. This revolution is more than twice as rapid as that of the nodes, being performed in $3232\cdot 57$ mean solar days, or $8\cdot 85$ solar years.

The moon, like all other satellites, as far as at present known, revolves round her own axis in precisely the same time that she revolves round the earth; she thus presents always the same face to us, and consequently, though her comparative proximity has enabled us to become better acquainted with her surface than with that of any other heavenly body, our knowledge is confined to one-half of her surface, with the slight exception of the knowledge obtained from her libration. To the inhabitants of the side of the moon next the earth—if the moon had inhabitants, which is very improbable—the latter would appear as a luminary about 2° in diameter, immovably fixed in their sky, or at least changing its position only to the extent due to the moon's libration. The earth would thus seem to them to have a disc about fifteen times larger than that of the sun.

The surface of the moon, as seen from the earth, presents a most irregular grouping of light and shade. The dark portions were named by the earlier astronomers as seas, lakes, etc., and still retain these names, although there is strong evidence against the supposition that the moon, or at least that portion of it presented to us, contains any water. The brighter

parts of the moon are mountainous, as is proved by the fact of their casting shadows when the sun's rays fall upon them obliquely, and also by the ragged appearance presented by the interior illuminated border of the moon, an appearance which can only be satisfactorily accounted for on the supposition that the surface of the moon is not level, in which case the higher portions will be illuminated some time before the light reaches the level parts; and it is observed that as the illumination proceeds, bright spots start up in advance of it, and when the moon is on the wane, these same spots continue to shine for some time after the surrounding surface is immersed in gloom. The mountains occur either singly, when they are generally of a circular form, and are called *craters*, or in groups, which are mostly annular, and form a sort of wall enclosing a deep depression or plain, in which are situated one or more conical mountains. The craters are not unfrequently eight or ten miles in diameter, and some of the walled plains measure more than one hundred miles across. The principal mountain range is the Appenines, which crosses the surface from northeast to southwest, and attains, according to some authorities, an altitude of about twenty thousand feet, though Sir John Herschel gives about two miles as the probable limit of elevation above the moon's surface. The heights are estimated from a micrometric measurement of the length of their shadows, a method not, in this case, susceptible of much accuracy. The moon everywhere presents traces of volcanic agency, but no active volcanoes have yet been discovered, nor is there any sign of recent volcanic action. Seen through the telescope she presents a bleak, desolate appearance, without indications of animal or vegetable existence. She appears to be devoid of an atmosphere, or if one exists, it must be of exceeding rarity.

The influence of the moon in causing *tides* has long been well known, and there is some reason for supposing that she produces a similar effect on the atmosphere, combining with other causes in the generation of winds. Those winds which prevail about the time of new and full moon, and at the vernal and autumnal equinoxes, are particularly ascribed to her influence. On the supposition that the moon might also affect organic nature, experiments were instituted by Mead, Hoffman and others; but no certain results were attained. The periodicity which has often been noticed in certain diseases, especially in insanity (hence called *lunacy*), was long supposed to have some connection with lunar influence, and this opinion is held to some extent at the present day. The chemical effects of the moon's rays are, so far as is at present known, feeble, though in particular instances they exhibit an *actinism* as powerful as that of the sun. Decomposition of animal matter takes place more rapidly in moonshine than in darkness, and the moon's rays, when concentrated, have a sensible effect on the thermometer.

The Planets.—The planets are those heavenly bodies (including the Earth) which belong to our solar system, and revolve in elliptic orbits round the sun. They are often denominated *primary planets*, to distinguish them from their moons or satellites, which are called *secondary planets*. The name planet is of considerable antiquity, and was applied to these dependants of the sun to distinguish them from the myriads of luminous bodies which stud the sky, and which present to the naked eye no indication of change of place. The planets at present known are, in the order of their distance from the sun, Mercury, Venus, the Earth, Mars, the Planetoids, Jupiter, Saturn, Uranus and Neptune. Six of these, Mercury, Venus, the Earth (which was not, however, then reckoned a planet), Mars, Jupiter,

and Saturn, were known to the ancients; Uranus was discovered by Sir William Herschel in 1781; and Neptune, after having its position and elements determined theoretically by Leverrier and Adams, was discovered by M. Challis, and afterwards by Dr. Galle, in 1846. The Planetoids, of which more than two hundred and twenty are now known, have all been discovered during the present century. Six of the planets, the Earth, Mars, Jupiter, Saturn, Uranus, and Neptune, are attended by one or more satellites; Uranus (generally), Neptune, almost the whole of the Planetoids, and all the satellites except the Moon, are invisible to the naked eye. The visible planets can be at once distinguished from the fixed stars by their clear steady light, while the latter have a sparkling or twinkling appearance. The comparative proximity of the planets may be proved by examining them through a telescope of moderate power, when they appear as round luminous disks, while the fixed stars exhibit no increase of magnitude. The planets, as observed from the Earth, move sometimes from west to east, sometimes from east to west, and for some time remain stationary at the point where progression ends and retrogression commences. This irregularity in their movements was very puzzling to the ancient astronomers, who invented various hypotheses to account for it. The system of Copernicus, by assuming the sun, and not the Earth, as the center of the system, explained with admirable simplicity what seemed before a maze of confusion.

The planetary orbits differ considerably in their degrees of eccentricity, the Planetoids, Mars, and Mercury being most, and the larger planets least eccentric. No two planets move exactly in the same plane, though, as a general rule, the planes of the larger planets most nearly coincide with that of the ecliptic. The latter are consequently always to be found within a small strip of the heavens extending on both sides of the ecliptic, while the others have a far wider range. According to Kepler's Laws, the nearer the planet is to the sun the shorter is the time of its revolution. The arrangement of the planets in the solar system bears no known relation to their relative size or weight, for though Mercury, Venus, and the Earth follow the same order in size and distance from the sun, yet Mars, which is farther from the sun, is much less than either the Earth or Venus, and the Planetoids, which are still farther off, are the least of all. Jupiter, which is next in order, is by far the largest, being about one and one-half times as large as all the others together; and as we proceed farther outwards, the planets become smaller and smaller, Saturn being less than Jupiter, Uranus than Saturn, and Neptune than Uranus.

With reference to their distance from the sun, as compared with that of the Earth, the planets are divided into *superior* and *inferior*; Mercury and Venus are consequently the only "inferior" planets, all the others being "superior." The inferior planets must always be on the same side of the Earth as the sun is, and can never be above the horizon of any place (not in a very high latitude) at midnight; they are always invisible at their superior and inferior conjunctions, except when, at the latter, a *transit* takes place. The superior planets are likewise invisible at conjunction, but when in opposition they are seen with the greatest distinctness, being then due south at midnight. The time which elapses from one conjunction to its corresponding conjunction is called the *synodic period* of a planet, and in the case of the inferior planets must always be greater than the true period of revolution.

Mercury, the planet which is nearest the sun, is also, with the exception of the Planetoids, the smallest (being only three times the size of the moon),

and performs its revolution round the sun in the shortest time. Its greatest elongation is never more than $28^{\circ} 45'$, and consequently it is never above the horizon more than two hours after sunset, or the same time before sunrise; on this account, and from its small apparent size ($5''$ to $12''$), it is seldom distinctly observable by the naked eye. It shines with a peculiarly vivid white or rose-colored light, and exhibits no spots.

Venus, the next in order of distance and period, is to us the most brilliant of all the planets. Its orbit is more nearly a circle than any of the others, and when at its inferior conjunction, it approaches nearer the Earth than any other planet. Its apparent angular dimensions thence vary from $10''$ at the superior, to $70''$ at the inferior conjunction. Its greatest elongation varies from 45° to $47^{\circ} 12'$, and therefore it can never be above the horizon for much more than three hours after sunset, or the same time before sunrise. While moving from the inferior to the superior conjunction, Venus is a *morning star*; and during the other half of its synodic period, an *evening star*. When this planet is at an elongation of 40° , its brilliancy is greatest, far surpassing that of the other planets, and rendering a minute examination through the telescope impossible. At this period it sometimes becomes visible in the daytime, and after sunset is so bright as to throw a distinct shadow. Astronomers have repeatedly attempted to ascertain the nature and characteristics of its surface, but its brightness so dazzles the eyes as to render the correctness of their observations at best doubtful. From the changes in the position of dusky patches on its surface, which have been frequently noticed, it is concluded that it revolves on its axis, and that its equator is inclined to the plane of its orbit at an angle of 75° ; but many astronomers (Sir John Herschel included) profess to doubt these conclusions. Both Venus and Mercury necessarily exhibit phases like the moon.

The *Earth*, the next planet in order, is described elsewhere; it has a single satellite, the *Moon*.

Mars, the first of the superior planets, is much inferior in size to the two previous, its volume being about one-half of the Earth's, and, after Mercury, its orbit is much more eccentric than those of the other planets. When it is nearest to the Earth (i. e., in opposition), its apparent angular diameter is $30''$; but when farthest from it (i. e., in conjunction), its diameter is not more than $4''$. It shines with a fiery red light, and is a brilliant object in the heavens at midnight when near opposition; when seen through the telescope its surface appears to be covered with irregular blotches, some of them of a reddish, others of a greenish color, while at each pole is a spot of dazzling white. The red spots are surmised to be land; the green, water, while the white spots at the poles are with some reason supposed to be snow, since they decrease when most exposed to the sun, and increase under the contrary circumstances. Two small satellites of this planet were discovered in August, 1877.

The Planetoids.—After Mars in order come the *Planetoids*, formerly, but improperly, called Asteroids. They are a numerous group of very small planets situated in the solar system between Mars and Jupiter. The number now known is two hundred and twenty. They are believed to be fragments of one older planet; their distances from the sun are from 200,000,000 to 300,000,000 miles, and the largest is not over three hundred miles in diameter.

Jupiter, the next in order, is the largest of all the planets, its bulk being more than one thousand four hundred times that of the Earth, though, from its small density, its mass is only three hundred and thirty-eight times

more. After Venus it is the brightest of all the planets and the largest in apparent size, its angular diameter varying from 30" to 45". When looked at through a telescope, it is seen to be considerably flattened at the poles, owing to its rapid revolution on its own axis; and its surface is crossed in a direction parallel to its equator by three or four distinct and strongly-marked belts, and a few others of a varying nature. Spots also appear and remain for some time on its surface, by means of which its revolution on its axis has been ascertained. This planet is attended by four satellites, which are easily observable through an ordinary telescope, and which have rendered an immense service in the determination of longitudes at sea, and of the motion and velocity of light. The satellites, which were discovered by Galileo, were proved by Sir William Herschel to revolve on their own axes in the same time that they revolve round their primary. The smallest is about the same size as our moon, the others are considerably larger.

Saturn, next in position, is about seven hundred and thirty-five times larger in volume, though only about one hundred times greater in mass than the Earth. Its apparent diameter when in opposition is 18", and there is a considerable flattening towards the poles. Its surface is traversed by dusky belts much less distinctly marked than those of Jupiter, owing doubtless in great part to its inferior brightness; its general color is a dull white or yellowish, but the shaded portions, when seen distinctly, are of a glaucous color. The most remarkable peculiarity of Saturn is its ring, or series of concentric rings, each one parallel and in the same plane with the others and with the planet's equator; the rings are at present supposed to be three in number, the two outermost are bright like the planet itself, while the innermost is of a purplish color, and is only discernible through a powerful telescope. The rings are not always visible when Saturn is in the "opposite" half of its orbit, for when the plane of the rings is intermediate between that of the Earth's orbit and of the ecliptic, their dark surface is turned towards us, and when the sun is in their plane only the narrow edge is illuminated; in both of these cases the ring is invisible from the Earth. Its plane being inclined at an angle of 28° to the ecliptic, we see the two surfaces of the ring alternately for periods of fifteen years at a time; and at the middle of each period, the rings attain their maximum obliquity to the ecliptic, and are then best seen from the Earth. It is hardly necessary to remark that at the end of each period they become invisible. Saturn has also no less than eight satellites, seven of which revolve round it in orbits little removed from the plane of the ring, while the eighth, which is the second in size, is considerably inclined to it. The satellites are all situated outside of the ring, and the largest of them is nearly equal to the planet Mars in size.

Uranus, the next planet in position, was discovered accidentally by the elder Herschel, on March 13, 1781, and was named "the Georgium Sidus" and "Herschel," but these names soon fell into disuse. It is about ninety-six (some astronomers say eighty-two) times greater than the Earth in volume and twenty (according to others, fifteen) times in mass; but though so large, its distance is so much greater in proportion that astronomers have been unable to gain much information concerning it. No spots or belts have hitherto been discovered on its surface, and consequently its time of rotation and the position of its axis are unknown. It is attended by a number of satellites, but so minute do these bodies appear, that astronomers hitherto have been unable to agree as to their exact number; Sir William Herschel reckoned six, while other astronomers believe in the existence of four, five, and eight respectively. That there are at least four is without doubt.

Neptune is the next and outermost member of the solar system, and, at a distance of nearly 3,000,000,000 miles from the center of the system, slowly performs its revolution round the sun, accomplishing the complete circuit in about 165 solar years. It is about 84 times larger than the Earth, but from its extreme remoteness is of almost inappreciable magnitude when seen through an ordinary telescope. It was the disturbance in the motion of *Uranus* caused by the attractive force of this planet which led Leverrier and Adams to a calculation of its size and position, on the supposition of its existence; and the directions which were given by the former to Dr. Galle, of Berlin, specifying its exact position in the heavens, led that astronomer to its discovery on September 23, 1846. Mr. Lassell, of Liverpool, has discovered that *Neptune* is attended by one satellite. The satellites of *Uranus* and *Neptune* differ from the other planets, primary and secondary, in the direction of their motion, which is from east to west, and in the case of the former, in planes nearly perpendicular to the ecliptic. Both *Uranus* and *Neptune* were observed long before the times of Herschel and Leverrier, but they were always supposed to be stars. *Uranus* is known to have been observed by Flamsteed between 1690 and 1715, and *Neptune* by Lalande in 1795.

The Stars.—Stars are distinguished from planets by remaining apparently immovable with respect to one another, and hence they were early called fixed stars, a name which they still retain, although their perfect fixity has been completely disproved in numerous cases, and is no longer believed in regard to any. Twinkling, or scintillation, is another mark which distinguishes stars from planets.

The first thing that strikes the observer is the apparent daily motions of the stars. The greater part appear to rise in the east, describe smaller or greater arcs in the heavens, and set in the west; while others describe complete circles round a point north of the zenith, that described by the so-called polar star being the smallest visible to the naked eye. These apparent motions arise from the rotation of the earth on its axis. Had the earth only this rotary motion, the aspect of the starry heavens at any spot on the earth's surface would be the same at the same hour of the night all the year round; which is known not to be the case. In consequence of the earth's motion round the sun, or the apparent advance of the sun among the stars, the aspect of the heavens at a particular hour is always changing. The same position of the stars recurs four minutes earlier each night, and only at the same time after the lapse of a year.

With few exceptions, the distance of the fixed stars is still unknown, and must in all be enormously great. Since the time of Bradley, many attempts have been made to measure what is called the *yearly parallax* of the stars, and thus determine their distances. When we consider that the motion of the earth round the sun brings us at one time a whole diameter of its orbit (184 millions of miles) nearer to a particular region of the heavens than we were six months before, we should expect a change in the relative distances of the stars as seen from the two points—that as we approach them they should seem to separate. But no such change is seen to take place; and this was one of the early objections to the theory of Copernicus. The only answer that the Copernicans could give was, that the distance of the stars from us is so great that the diameter of the earth's orbit is as a point compared with it. The detection of the parallax of the fixed stars depended upon the perfection of instruments. The parallax of a star is the minute

angle contained by two lines drawn from it, the one to the sun, the other to the earth. If that angle amounted to a second, the distance of the star would be 206,000 times that of the sun; and when the measurement of angles came to be reliable to a second, and still no parallax was discernible, astronomers could say that the distance of the nearest stars must be more than 206,000 times that of the sun—i. e., 206,000 times ninety-two millions of miles, or about twenty billions of miles. It is only since between 1832 and 1838 that anything like positive determinations of parallax have been made, chiefly by Henderson, Bessel, and Peters. The first published (Dec., 1833) was that of the double star sixty-one in the constellation of the Swan, by Bessel, who made the parallax $0''.37$, giving a distance over 550,000 times that of the sun, or fifty-two billions of miles, so that the light of this star is about eight and two-thirds years in reaching the earth. The nearest of all the stars yet measured is a *Centauri*, the finest double star in the southern heavens, whose parallax was determined by Henderson and Maclear at the Cape of Good Hope to be $0''.9128$ (the observations were made in 1832–1833; the result read before the Astronomical Society, Jan., 1839), or as subsequently corrected, $0''.976$, corresponding to a distance of about twenty billions of miles, and requiring three and one-third years for its light to reach us. To Sirius, the brightest of the stars, a parallax of $0''.15$, has been assigned, implying a distance six times that of a *Centauri*. It has been considered probable, from recondite investigations, that the average distance of a star of the first magnitude from the earth is 986,000 radii of our annual orbit, a distance which light would require fifteen and one-half years to traverse; and further, that the average distance of a star of the sixth magnitude (the smallest distinctly seen without a telescope) is 7,600,000 times the same unit—to traverse which, light, with its prodigious velocity, would occupy more than one hundred and twenty years. If, then, the distances of the majority of stars visible to the naked eye are so enormously great, how are we to estimate our distance from those minute points of light discernible only in powerful telescopes? The conclusion is forced upon us that we do not see them as they appeared within a few years, or even during the lifetime of man, but with rays which proceeded from them several thousands of years ago!

The stars have been divided into groups called Constellations from the earliest times. The several stars belonging to the same constellation are distinguished from one another by Greek letters, beginning the alphabet with the brightest; and when these are not sufficient, by Roman letters and by numbers. Many of the most brilliant stars have special names. They are also divided according to their brightness into stars of the first, second, third, etc., magnitudes—a division which is necessarily somewhat arbitrary. The smallest stars discernible by a naked eye of ordinary power are usually called stars of the fifth magnitude; but an usually sharp eye can discern those of the sixth and even seventh magnitude. All below are *telescopic* stars, which are divided in a very undetermined way down to the twentieth magnitude. Sir J. Herschel has determined that the light of Sirius, the brightest of all the stars, is 324 times that of a mean star of the sixth magnitude. By processes of photometric observation and reasoning, it is concluded that the intrinsic splendor a *Centauri* is more than twice that of our sun, and that of Sirius 394 times. Among stars of the first magnitude in the northern hemisphere are usually reckoned Aldebaran (in Taurus), Arcturus (in Bootes), Atair (in Aquila), Betelgeux (in Orion), Capella (in Auriga), Procyon (in Canis Minor), Regulus (in Leo), Vega (in Lyra). In

the southern hemisphere are Aelhernes (in Eridanus), Antares (in Scorpio), Canopus (in Argo), Rigel (in Orion), Sirius (in Canis Major), Spica (in Virgo), and *α Centauri* and *α Crucis* that have no special names.

No apparent magnitude, in the proper sense of the word, has yet been observed in any star. In the best and most powerful magnifying telescopes, even the brightest stars of the first magnitude appear, not with small discs as all the planets do, but as luminous points without any visible diameter, and always the smaller the better the telescope. We are therefore totally ignorant of the real size of the fixed stars; nor could it be determined though we were sure of their distances, for the apparent diameter is an essential element in the calculation. We cannot, then, say whether the greater brilliancy of one star, when compared with another, arises from its greater nearness, its greater size, or the greater intensity of its light. It is certain that all the fixed stars are self-luminous. By the spectroscope several facts regarding their physical constitution have been made out; there are great differences in their spectra; the existence of several known elements is considered demonstrated. Sirius contains hydrogen, sodium, and magnesium.

The number of the stars is beyond determination. Those visible by the naked eye amount only to a few thousands. Stars of the first magnitude are usually reckoned at 15 to 20, of the second at 50 to 60, of the third about 200, of the fourth at 400 to 500, of the fifth at 1100 to 1200. But in the following classes the numbers increase rapidly, so that stars of the sixth and seventh class amount to above 12,000. Stars are most dense in that region of the heavens called the Milky Way, which is mostly composed of stars of the eleventh and twelfth magnitude. W. Herschel observed 116,000 stars pass the field of his telescope in a quarter of an hour, while directed to the densest part of the Milky Way.

That the fixed stars are not really immovable, as their name would imply, is seen in the phenomenon of *Double* or *Multiple Stars*, which are systems of two or more stars that revolve about one another, or rather about their common center of gravity. As they can be seen separate only by means of a telescope, and in most cases require a very powerful one, their discovery was possible only after the telescope was invented. Galileo himself discovered their existence, and proposed to make use of them in determining the yearly parallax of the fixed stars. After a long lapse of time, Bradley, Maskelyne, and Mayer again directed attention to the phenomena of double stars; but nothing important was made out respecting them till the elder Herschel made them the subject of a protracted series of observations which led to the most remarkable conclusions as to their nature. The united observations of Struve, Savary, Encke, South, and especially those of Herschel the younger, continued for four years in the southern hemisphere at the Cape of Good Hope, have raised the number of observed double, or rather multiple, stars to more than 6,000, of which the greater part are binary, or composed of two, but many are triple, some quadruple, and a few even quintuple, or consisting of five stars. The distance between the stars composing these systems is always apparently small (varying from less than 1" up to 32"); but apparent nearness does not always constitute a double star, for two really distant stars are not unfrequently so nearly in the same line, as seen from the earth, that they appear to be close together. In real multiple stars, the individuals are not only comparatively near to one another, but they revolve around one another. Among stars of the first three magnitudes, every sixth is a multiple star; among the smaller stars

the proportion is much less. In some cases, one of the stars is much larger than the other, as in the star Rigel in Orion, and in the polar star; but oftener the connected stars are nearly equal in luminous power. The two members of double stars are mostly of one color, but a difference of color is observed in about one-fifth of the whole number. In many of these cases, the one color is the complement of the other, and it is possible that the color of the smaller star may be subjective, arising from the action of the other upon the eye.

Several stars exhibit well-marked periodic alterations of a striking nature, and are hence called *variable stars*. A considerable number have been observed, of which the most remarkable are Mira (the "wonderful") in Cetus, and Algol in Perseus. The first attains its greatest lustre every 334 days, and appears for fourteen days as a star of the second, and even at times of the first magnitude; it then decreases for two or three months, till it becomes of the sixth and even tenth magnitude, so as to be for half a year invisible to the naked eye and usually to telescopes. After this it begins again to increase, but more rapidly than it decreased. It is visible to the naked eye for three or four months of its period. Of all the variable stars yet observed in Perseus, Algol has the shortest period, being sixty-eight hours forty-nine minutes. It appears for about sixty hours a star of the second magnitude, then decreases for four hours, and appears for a quarter of an hour of the fourth magnitude, after which it increases again for four hours. Various explanations have been offered of these mysterious appearances; the stars are supposed to turn on their axis, and to have their surfaces equally luminous in different places; or a large dark body is assumed to be revolving about the luminous one, so as to intercept more or less of its light in different positions; or the stars are lens-shaped, etc. There is nothing, however, inadmissible in the supposition that the intensity of the light itself may vary; and if in other suns, why not in our own?

Allied to the variable stars are the *new* or temporary stars that appear suddenly in great splendor, and then disappear without leaving a trace. A number of instances are on record. It is not impossible that these also may be periodic.

From the appearances connected with the Milky Way or Galaxy, Sir W. Herschel came to the conclusion that the stars forming our firmament do not extend indefinitely into space, but are limited in all directions, the mass having a definite shape. He conceived the shape to be something like that of a huge millstone, having one side cleft, and the two laminae set apart at a small angle. This supposition accounts for the appearance of the Milky Way, and all subsequent observations have tended to confirm the conjecture: Situated as we are within the system, we cannot hope ever to attain more than a rude notion regarding it; to get a definite outline, we must be placed without it.

But this star system, which we may call our own, as our sun belongs to it, is but an item in the stellar universe. The appearances known as *nebulae*, in many cases at least, are believed to be similar agglomerations of suns, separated from our system and from one another by unfathomable starless intervals. Their forms are very various, but in general pretty well defined and not without symmetry. The aspect of some of them is even startling.

Comets.—The word comet is derived from the Gr. *kome*, hair, a title which had its origin in the hairy appearance often exhibited by the haze or luminous vapor, the presence of which is at first sight the most striking

characteristic of the celestial bodies called by this name. The general feature of a comet are—a definite point or nucleus, a nebulous light surrounding the nucleus, and a luminous train preceding or following the nucleus. Anciently, when the train preceded the nucleus—as is the case when a comet has passed its perihelion and recedes from the sun—it was called the *beard*, being only termed the tail when seen following the nucleus as the sun is approached. This distinction has disappeared from all modern astronomical works, and the latter name is given to the appendage, whatever its apparent position. Neither this luminous attendant, the tail, nor the nucleus, is now considered an essential cometary element, but all bodies are classed as comets which have a motion of their own and describe orbits of an extremely elongated form. There are several plain points of difference between comets and planets. The planets move in the same direction, from west to east, which is astronomically called “direct motion;” but the movements of comets are often from east to west, or retrograde. The orbits of all the planets are confined to a zone of no great breadth on either side of the ecliptic; but the paths of comets cut the ecliptic in every direction, some being even perpendicular to it. The orbits of all the planets are nearly circular; or, more properly speaking, are ellipses of very small eccentricity. The orbits of comets, on the other hand, present every variety of eccentricity, some of them being ellipses or elongated closed orbits of various degrees of elongation; others, hyperbolæ; while the majority have a form of orbit not differing sensibly from the parabola, which is the limiting form of curve to which both the ellipse and hyperbola approximate under given conditions.

The discovery that comets are celestial bodies, extraneous to our atmosphere, is due to Tycho Brahe, who ascertained the fact by observations of the comet of 1557. Newton succeeded in demonstrating that they are guided in their movements by the same principle which controls the planets in their orbits; and Halley was the first, by determining the parabolic elements of a number of comets from the recorded observations, to identify the comet of 1682 with one which had been observed in 1607 and the observations recorded by Kepler and Longomontanus, and also with a comet observed in 1531 by Apian, at Ingolstadt, and thus confidently to predict the return, at the end of 1758 or beginning of 1759, of a comet which would have the same parabolic elements.

The celebrated comet of 1680, which furnished Newton with the occasion for proving that comets revolve around the sun in conic sections, and that, consequently, they are retained in their orbits by the same force as that which regulates the movements of the planets, appears to have been about the most remarkable for brilliancy of any of which we have authentic accounts. This comet is supposed to be identical with the one that appeared about the time of Cæsar’s death (44 B.C.), with that which was seen in the reign of Justinian in the year 531, and with another in the year 1106, in the reign of Henry II, the period of revolution, according to the orbit calculated for it by Whiston, being about 575 years. There is, however, some doubt among astronomers as to the real form of its orbit, the one assigned to it by Encke giving it a period of 8,813 years. This comet approached nearer to the sun than any known, except perhaps the comet of 1843, the calculation of whose perihelion distance, from the paucity of observations, has little certainty. The comet of 1680 approached the sun within the 163d of the semi-diameter of the earth’s orbit. The tail of a comet is nearly always away from the sun, frequently assuming a curved form. It increases in

length with its proximity to the sun, but does not acquire its greatest length till after passing the perihelion. These are usual characteristics of comets, which were exemplified by this one in a remarkable degree. These phenomena might be accounted for if we were to regard the train as vaporization produced by the intense heat to which the body of the comet is exposed in its approach to the sun.

In the present century, the comets most remarkable for brilliancy have been the comet of 1811, that of 1843, that of 1858, and that of 1882.

Spectroscopic investigation, so far as yet pursued, points to the conclusion that the nucleus is self-luminescent, but that the tail shines with reflected light. It has been discovered recently, in determining the tracks of those streams of dark bodies that cause meteoric showers, that some of the tracks coincide with the orbits of well-known comets. From this, it is inferred that star showers and comets may be only different manifestations of the same thing.

The Aurora Borealis, or Northern Lights.—This is the name given to the luminous phenomenon which is seen towards the north of the heavens by the inhabitants of the higher latitudes. During the winter of the northern hemisphere, the inhabitants of the arctic zone are without the light of the sun for months together, and their long, dreary night is relieved by the light of this beautiful meteor, which occurs with great frequency in these regions. Those who have explored the southern seas have seen the same phenomenon in the direction of the south pole, so that the term polar lights might be more appropriate than northern lights to designate the aurora. The appearance of the aurora borealis has been described by a great variety of observers, all of whom give substantially the same account of the manner in which the phenomenon takes place. It is briefly as follows: A dingy aspect of the sky in the direction of the north is generally the precursor of the aurora; and this gradually becomes darker in color, and assumes the form of a circular segment surrounded by a luminous arch, and resting at each end on the horizon. This *dark segment*, as it is called, has the appearance of a thick cloud, and is frequently seen as such in the fading twilight before the development of the auroral light. Its density must, however, be very small, as stars are sometimes seen shining brightly through it. This dark segment is bounded by a luminous *arch* of a bluish-white color, which varies in breadth from one to six diameters of the moon, having the lower edge sharply defined, and the upper edge only when the breadth of the arch is small. This arch may be considered to be a part of a luminous ring elevated at a considerable distance above the earth's surface, and having its center corresponding with some point near the north pole. An observer several degrees south of this auroral ring would see towards the north only a small arc of it, the larger part being hid by the earth; to one situated not so far south, it would appear as a larger and higher arch; to one placed below it, it would be seen as an arch passing through the zenith; and to one situated within the ring and farther north, it would be found as an arch culminating in the south. On this supposition, nearly all the various positions of the auroral arch may be accounted for. The center of the ring corresponds probably with the magnetic north, which is at present situated in the island of Boothia-Felix. Hence it is that in Greenland, which is situated to the east of this island, the auroral arch has been seen stretching from north to south, with its highest point in the west. The luminous arch, once formed, remains visible for several hours, and is

in a constant state of motion. It rises and falls, extends towards the east and towards the west, and breaks sometimes in one part, and sometimes in another. These motions become all the more observable when the arch is about to shoot forth *rays*; then it becomes luminous at one point, eats in upon the dark segment, and a ray of similar brightness to the arch mounts with the rapidity of lightning towards the zenith. The ray seldom keeps the same form for any length of time; but undergoes continual changes, moving eastward and westward, and fluttering like a ribbon agitated by the wind. After some time, it gradually fades in brightness, and at last gives way to other rays. When the aurora attains its full brightness and activity, rays are projected from every part of the arch, and if they do not rise too high, it presents the appearance of a comb furnished with teeth. When the rays are very bright, they sometimes assume a green, sometimes a violet, a purple, or a rose color, giving to the whole a variegated and brilliant effect. When the rays darted by the luminous arch are numerous and of great length, they culminate in a point which is situated in the prolongation of the dipping-needle, somewhat southeast of the zenith. There they form what is called the *boreal crown*; and the whole heavens, towards the east, west and north present the appearance of a vast cupola of fire, supported by columns of variously colored light. When the rays are darted less brilliantly, the crown first disappears, then, here and there, the light becomes faint and intermittent, till at last the whole phenomenon fades from the sky.

The intimate connection between the aurora borealis and the magnetism of the earth is shown by various facts. During the occurrence of the phenomenon, the magnetic needle appears very much disturbed, sometimes deviating several degrees from its normal position, and appearing to be most affected when the aurora is brightest; and this oscillation is frequently perceived far beyond the district where the aurora is seen. The vertex, likewise, of the luminous arch is almost always found to be in or very near the magnetic meridian, and the boreal crown has its seat in the prolongation of the freely suspended needle. There seems, moreover, to be a connection between the magnetic poles of the earth in regard to the aurora, for, so far as has been ascertained, the meteor occurs simultaneously at both. The aurora borealis appears to be an electric discharge connected with magnetic disturbance. If one of Gassiot's vacuous tubes be brought near an electric machine, or between the poles of an induction coil, flashes of light pass between the ends, which bear a striking resemblance to the aurora borealis. A comparison of the spectra of the two goes far to establish identity. The auroral spectral line, according to Angstrom, is a yellow line near the sodium line, and is the same as the air line seen in the solar light when the sun is near the horizon. Other lines, however, have been seen, which cannot as yet be produced by the physicist from any known substance.

Sound.—Sound is the impression produced on the ear by the vibrations of the elastic medium, such as air or water, in which it is plunged. That this is the case is proved, first, by the fact that a bell or tuning fork in *vacuo* gives no sound when struck, second, by the fact that mere currents, as such (winds, running water, etc.) do not produce the sensation of sound until they are frittered down into vibratory motion by obstacles.

The most untutored ear distinguishes at once between a mere *noise* and a *musical note*. It of course distinguishes a *loud* sound from a faint one. Moreover, it distinguishes musical notes from one another by their shrill-

ness or gravity, or, as it is technically called, their *pitch*. Again, as in the case of vowel-sounds sung to the *same* musical note, or, as in the case of different instruments (flute and violin, for instance) playing the same note, it distinguishes something further—which is called the quality of the note. It is on the pitch of notes that the theory of music is based, for the quality is only of importance in giving variety, as in orchestral music—or in giving richness of tone in a solo. The most perfect *music*, so far as theory goes, may be executed on the poorest instrument, but it gives little pleasure, from the want of richness or quality. In the same way a singer may possess faultless intonation, yet the performance, though *musically* perfect, may, from the harsh *quality* of the voice, be unpleasant. We intend, in the present article, to avoid everything connected with music, and have made these remarks to show that there is something in the theory of sound more profound than is contemplated in the theory of music.

The questions we have now to discuss are:

1. What constitutes the difference between a mere noise and a musical note?

2. On what does the pitch of a note depend?

3. On what does its quality depend?

The answers to these queries are all contained in the following statement:

“Every musical note consists in the repetition, at equal small intervals of time, of some definite noise; the pitch depends on the rate of repetition; and the quality upon the nature of the fundamental noise.”

If, for instance, the edge of a card be held to a revolving toothed-wheel, a definite noise is produced as each tooth bends the card and allows it to spring back. While the wheel revolves slowly, we can distinguish these successive noises; but when it is revolving so fast that they are no longer separately distinguishable, the character of the sound changes completely. It now becomes continuous, and, so far as the ear can detect, uniform, and thus becomes a musical note. As the wheel is made to revolve faster and faster, the pitch of the note rises, till it becomes a sort of shriek, and finally becomes inaudible. The “Sirene” gives another excellent illustration. In this case, the fundamental noise is produced by a puff of air escaping from an orifice; and we observe, just as before, that the greater the number of such puffs per second, after they have become so frequent as to be separately undistinguishable, the higher is the pitch of the musical note produced.

Now, if by machinery we arrange matters so that the sirene and the toothed-wheel give the number of puffs and the number of impacts on the card the same per second, the musical note produced by each has the same pitch. But the notes differ greatly in quality, the one being exceedingly soft and pleasant, and other harsh and grating. The pitch, therefore, depends on the number of noises per second, and the quality upon the nature of the fundamental noise.

As the velocity of sound is ten times greater than that of wind in the most violent hurricane, it is not *air* itself which is transferred from place to place, but a *state of disturbance* (condensation or rarefaction) of the air. Each successive layer of air in the path of the sound suffers this disturbance in turn, and by virtue of its elasticity, passes it on to the next.

New on was the first who attempted to deduce from mechanical principles the velocity of sound, but only for the particular case in which each particle of air, in the path of the sound, is supposed to move backwards and forwards according to the same law as the bob of a pendulum. He showed

that this species of motion is consistent with the elastic properties of air, as given by Boyle's or Mariotte's Law, viz., that the pressure of air is proportional to its density. The velocity of sound in this case is of course to be found from the time which elapses between the commencement of the motion of any one particle of air, and that of another at a given distance from it, in the direction in which the sound is moving. The numerical result deduced by Newton with the then received experimental data for the compressibility of air, was 979 feet per second. This investigation was very defective, applying, in fact, solely to the special case of a pure musical note, continually propagated without lateral divergence; yet the solution obtained by Lagrange from a complete analysis of the question, gave precisely the same mathematical result.

But, by direct measurements, carefully made, by observing at night the interval which elapses between the flash and the report of a cannon at a known distance, the velocity of sound has been found to be considerably greater—in fact, about 1,090 feet per second, at the temperature of freezing water.

Newton seeks for the cause of this discrepancy between theory and observation in the idea that the size of the particles of air is finite compared with their mutual distance; and that sound is instantaneously propagated through the particles themselves.

This is not one of Newton's happiest conjectures—for, independent of the fact that such an assumption would limit definitely the amount of compression which air could undergo, and, besides, is quite inconsistent with the truth of Boyle's law for even moderate pressure, it would result from it that sound should travel slower in rarefied, and quicker in condensed air. Now, experiment shows that the velocity of sound is unaffected by the height of the barometer; and, indeed, it is easy to see that this ought to be the case. For in condensed air the pressures are increased proportionally to the increase of condensation, and the mass of a given bulk of air is increased in the same proportion. Hence, in a sound-wave in condensed air, the forces and the masses are increased proportionally, and thus the rate of motion is unaltered. But the temperature of the air has an effect on sound, since we know that the elastic force is increased by heat, even when the density is not diminished; and therefore the velocity of sound increases with the temperature at the rate of about $4\frac{1}{2}$ feet per Fahrenheit degree as is found by experiment.

Newton's explanation of the discrepancy between theory and experiment being thus set aside, various suggestions were made to account for it; some, among whom was Euler, imagining that the mathematical methods employed, being only approximate, involved a serious error.

The explanation was finally given by Laplace, and is simple and satisfactory. When air is suddenly compressed (as it is by the passage of a sound-wave), it is heated; when suddenly rarefied, it is cooled, and this effect is large enough to introduce a serious modification into the mathematical investigations. The effect is in either case to increase the forces at work—for, when compressed, and consequently heated, the pressure is greater than that due to the mere compression—and, when rarefied, and consequently cooled, the pressure is diminished by more than the amount due to the mere rarefaction. When this source of error is removed, the mathematical investigation gives a result as nearly agreeing with that of observation as is consistent with the unavoidable errors of all experimental data. It is to be observed that, in noticing this investigation, nothing has

been said as to the pitch or quality of the sound, for these have nothing to do with the velocity. It must, however, be remarked here that, in the mathematical investigation, the compressions and rarefactions are assumed to be very small; i. e., the sound is supposed to be of moderate intensity. It does not follow, therefore, that very violent sounds have the same velocity as moderate ones, and many curious observations made during thunderstorms seem to show that such violent sounds are propagated with a greatly increased velocity. It is recorded that in one of Parry's arctic voyages, during gun-practice, the officer's command "Fire," was heard at great distances across the ice *after* the report of the gun.

Since sound consists in a wave-propagation, we should expect to find it exhibit all the ordinary phenomena of waves. Thus, for instance, it is *reflected* according to the same law as light. It is *refracted* in passing from one medium to another of different density or elasticity. This has been proved by concentrating in a focus the feeble sound of the ticking of a watch, and rendering it audible at a considerable distance, by means of a lens of collodion films filled with carbonic acid gas.

Sounds *interfere* to reinforce each other, or to produce silence; just as the crest of one wave may be superposed on the crest of another, or may apparently destroy all motion by filling up its trough. The simplest mode of showing this is to hold near the ear a vibrating tuning-fork and turn it slowly round its axis. In some positions, the sounds from the two branches reinforce, in others they weaken, each other. But if, while the sound is almost inaudible, an obstacle be interposed between the ear and one of the branches, the sound is heard distinctly.

To give an idea of the diminution of loudness or intensity of a sound at a distance from its source, let us consider a series of spherical waves diverging from a point. The *length* of a wave, as we know from the theory, does not alter as it proceeds. Hence, if we consider any one spherical wave, it will increase in radius with the velocity of sound, but its thickness will remain unaltered. The same disturbance is thus constantly transferred to masses of air greater and greater in proportion to the *surface* of the spherical wave, and therefore the amount in a given bulk (say a cubic inch) of air will be inversely proportional to this surface. But the surface of spheres are as the squares of their radii—hence the disturbance in a given mass of air, i. e., the loudness of the sound, is inversely as the square of the distance from the source. This follows at once from the law of conservation of energy, if we neglect the portion which is constantly being frittered down into heat by fluid friction. All sounds, even in the open air, much more rapidly in rooms, are extinguished ultimately by conversion into an equivalent of heat. Hence sounds really diminish in intensity at a greater rate than that of the inverse square of the distance; though there are cases on record in which sounds have been heard at distances of nearly 200 miles. But if, as in speaking-tubes and speaking-trumpets, sound be prevented from diverging in spherical waves, the intensity is diminished only by fluid friction, and thus the sound is audible at a much greater distance, but of course it is confined mainly to a particular direction.

As already remarked, the purest sounds are those given by a tuning-fork, which (by the laws of the vibration of elastic solids) vibrates according to the same law as a pendulum, and communicates exactly the same mode of vibration to the air. If two precisely similar tuning-forks be vibrating with equal energy beside each other, we may have either a sound of double the intensity, or anything less, to perfect silence, according to their relative

phases. If the branches of both be at their greatest elongations simultaneously, we have a doubled intensity—if one be at its widest, and the other at its narrowest, simultaneously, we have silence, for the condensation produced by one is exactly annihilated by the rarefaction produced by the other, and *vice versa*. But if the branches of one be loaded with a little wax so as to make its oscillations slightly slower, it will gradually fall behind the other in its motion, and we shall have in succession every grade of intensity from the double of either sound to silence. The effect will be a periodic swelling and dying away of the sound, and this period will be longer the more nearly the two forks vibrate in the same time. This phenomenon is called a *beat*, and we see at once from what precedes, that it affords an admirable criterion of a perfect *unison*, that is, of two notes whose pitch is the same. It is easy to see, by the same kind of reasoning, that if two forks have their times of vibration nearly as 1 : 2, 2 : 3, etc.—i. e., any simple numerical ratio—there will be greater intervals between the beats according as the exact ratio is more nearly arrived at.

Light.—Light is the subject of the science of optics. Every one knows that light diverges from a luminous center in all directions, and that its transmission in any direction is *straight*. It travels with great velocity, which has been ascertained, by observations on the eclipses of Jupiter's satellites and other means, to be 186,000 miles per second. Shadows are a result of its straight transmission; and it follows from its diverging in all directions from a luminous center, that its intensity diminishes inversely as the square of the distance from the center. When it falls on the surfaces of bodies, it is reflected from them, regularly or irregularly, totally or partially, or is partly or wholly transmitted or refracted through them. The facts of observation on which catoptrics is founded are two: 1. in the reflection of light, the incident ray, the normal to the surface, and the reflected ray are in one plane; 2. The angle of reflection is equal to the angle of incidence. Similar to these are the physical laws on which dioptrics is founded. When a ray of homogeneous light is incident on a refracting surface: 1. The incident and refracted ray lie in the same plane as the normal at the point of incidence, and on opposite sides of it; 2. The side of the angle of incidence, whatever that angle may be, bears, to the angle of refraction, a ratio dependent only on the nature of the media between which the refraction takes place, and on the nature of the light. In stating these laws, we have hinted at light being of different kinds. At one time it was not supposed that color had anything to do with light; now, there is no serious dispute but that there are lights of different colors with different properties, though obeying the same general laws.

Two hypotheses have been advanced to explain the different phenomena of light, viz.: the theory of *emission*, or the corpuscular theory, and the theory of *vibration*, or the undulatory theory. According to the former, light is an attenuated imponderable substance, whose colors depend on the velocity of its transmission. It regards reflection as analogous to the rebounding of elastic bodies; while to explain refraction, it assumes that there are interstices in transparent bodies, to allow of the passage of the particles of light, and that these particles are attracted by the molecules of bodies—their attraction combining with the velocity of the particles of light to cause them to deviate in their course. The undulatory theory assumes that light is propagated by the vibrations of an imponderable matter termed ether. On this view, light is somewhat similar to sound. Newton was the author

of the former theory, and Huyghens may be regarded as the author of the latter. The theories were long rivals, but now no doubt remains that the theory of undulations has triumphed over the other. Its soundness may be said to rest on similar evidence to that which we have for the theory of gravitation; it had not only satisfactorily accounted for all the phenomena of light, but it has been the means of discovering *new* phenomena. In fact, it has supplied the philosopher with the power of prescience in regard to its subject.

Heat.—Heat is the unknown cause of the sensation of warmth, and of a multitude of common phenomena in nature and art. In considering this subject scientifically, it is necessary, at the outset, to discard the ideas conveyed by the popular use of such words as heat and cold. A number of bodies, however different, left for a long enough time in the same room, must acquire the same *temperature*, or become in reality equally warm. Yet in popular language, some, as metals, stones, etc., are pronounced to be cold, and others, as flannel and fur, warm. The touch, then, is *not* a means by which we can acquire any definite idea of the temperature of a body.

A heated body is no heavier than it was before it was heated; if, therefore, heat be a material substance, as it was long considered, it must be *imponderable*. And, in fact, under the name of caloric or phlogiston, it is classed, in almost all but modern treatises, as one of the family of imponderables. But if it were *matter*, in any sense of the word, its quantity would be unchangeable by human agency. Now we find that there are cases in which heat is produced in any quantity without flame, combustion, etc., as in melting two pieces of ice by rubbing them together, and also cases in which a quantity of heat totally disappears. This is utterly inconsistent with the idea of the materiality of heat. The only hypothesis that at all accords with the phenomena is, that *heat is a form of motion*.

Whether it be a vibration, such as light and sound (in some cases, it certainly is), or consist in a succession of *impacts* of the particles of bodies on each other (as in some cases it has been considered to be), it is none the less certain that the *amount* of heat in a body is to be measured by the *vis-viva* of moving particles. But as we cannot observe those particles so as to ascertain their *vis-viva*, we must have some means of measuring the temperature of a body, depending upon an *effect* of heat. Whatever that effect may be, it is obvious that, as the laws of nature are uniform, it will afford us a *reproducible* standard, by which we can estimate its amount at any time and in any place, and compare that amount with another observed somewhere else; just as the French metre is reproducible at any time, being the ten-millionth part of a quadrant of the meridian.

Now, the most general and notable effect which heat produces on matter is to *expand* it. The length of a metallic bar varies with every change of temperature, and is ever the same at the same temperature. The fixing of the tire of a cart wheel is a very good instance. No hammering could fit an iron hoop so tightly on the wood-work of the wheel as the simple enlarging of the tire by heat, and its subsequent contraction by cold. It is thus possible to *slip* it on, and an enormous force is secured to bind the pieces together. In almost every kind of structure, the expansion and contraction from changes of temperature require to be guarded against. Watches and clocks, when not compensated, go faster in cold weather, and slower in hot; an immediate consequence of the expansion or contraction of their balance-wheels and pendulums.

☞ A flask full of water or alcohol be dipped into hot water or held over a

lamp, a portion of the liquid runs over; a glass shell which floats in a vessel of water, sinks to the bottom when the water is heated; and as water is heated, the hotter water continually rises to the surface. Indeed, if the latter were not the case, it would be impossible to prevent explosions every time we attempted to boil water or any other fluid. If a bladder, partly filled with air, and tightly tied at the neck, be heated before a fire, the contained air will expand, and the bladder will be distended. As it cools, it becomes flaccid again by degrees.

Regarding specific heat, the thermometer indicates the *temperature* of a body, but gives us no direct information as to the *amount* of heat it contains. Yet this is measurable, for we may take as our unit the amount of heat required to raise a pound of water from 0° to 1° , which is of course a definite standard. As an instance of the question now raised—Is *more* heat (and if so, *how much more*) required to heat a pound of water from zero to 10° , than to heat a pound of mercury between the same limits? We find by experiment that bodies differ extensively in the amount of heat (measured in the units before mentioned) required to produce equal changes or temperature in them.

It is a result of experiment (sufficiently accurate for all ordinary purposes) that if equal weights of water at different temperatures be mixed, the temperature of the mixture will be the arithmetic mean of the original temperatures. From this it follows, with the same degree of approximation, that equal successive amounts of heat are required to raise the same mass of water through successive degrees of temperature. As an instance, suppose one pound of water at 50° to be mixed with two pounds at 20° , the resulting temperature of the mixture is 30° ; for the pound at 50° has lost 20° , while each of the other two pounds has gained 10° . But if we mix water and mercury at different temperatures, the resulting temperature is found *not* to agree with the above law. Hence it appears that *to raise equal weights of different bodies through the same number of degrees of temperature, requires different amounts of heat*. And we may then define the *specific heat* of a substance as the number of units of heat required to raise the temperature of one pound of it by one degree.

By the definition of a unit of heat, it is at once seen that the specific heat of water is unity; and, in general, the specific heats of other bodies are less, and are therefore to be expressed as proper fractions. For example, if equal weights of water and mercury be mixed, the first at 0° , the second at 100° , the resulting temperature will not be 50° (as it would have been had both bodies been water), but $3^{\circ}23$ nearly—in other words, the amount of heat which raises the temperature of one pound of water $3^{\circ}2$, is that which would raise that of one pound of mercury $96^{\circ}77$, or the specific heat of mercury is 1-30th of that of water. The following may be given as instances of the great differences which experiment has shown to exist among bodies in respect of specific heat: Water, 1.000; turpentine, .426; sulphur, .203; iron, .114; mercury, .033.

It is mainly to the great specific heat of water that we are indebted for the comparatively small amount of it required to cool a hot body dropped into it; for its comparatively small loss of temperature when it is poured into a cold vessel, and the enormous effects of the water of the ocean in modifying climate.

We are now prepared to consider the somewhat complex effects produced by heat on the molecular constitution of bodies; and conversely, the relations of solidity, fluidity, etc., to heat. All bodies (except carbon, which

has been *softened* only) have been melted, by the application of a proper amount of heat. The laws of this fusion are:

1. Every body has a definite melting-point, assignable on the thermometric scale, if the pressure to which it is subjected be the same.

2. When a body is melting, it retains that fixed temperature, however much heat may be applied, until the last particle is melted. The last result is most remarkable. The heat applied does not raise the temperature, but *produces the change of state*. Hence it seems to disappear, as far as the thermometer is concerned, and was therefore called *latent heat*.

A pound of water at 79° C. added to a pound of *water* at 0° C., produces, of course, two pounds of water at $39^{\circ}5$. But, a pound of water at 79° C. added to a pound of *ice* at 0° C., produces two pounds of water at 0° . Heat, then, has *disappeared* in the production of a change from solidity to fluidity. And this we might expect from the conservation of energy, for actual energy in the shape of heat must be consumed in producing the potential energy of the molecular actions in the fluid. For every pound of ice melted, without change of temperature, seventy-nine units of heat are thus converted into change of molecular arrangement.

We give a few instances of latent heat of fusion: Water (as above), $79\cdot0$; zinc, $28\cdot1$; sulphur, $9\cdot4$; lead, $5\cdot4$; mercury, $2\cdot8$.

In law 1, it is mentioned that constancy of pressure is necessary. In fact, the freezing (or melting) point of water is *lowered* by increase of pressure, while those of sulphur and wax are *raised*; but these effects, though extremely remarkable, are *very small*. Most bodies contract on solidifying; some, however, as water, cast-iron, type-metal, etc., *expand*. Thus, a severe frost setting in after copious rain splits rocks, etc., by the expansion of freezing water; and thus also we obtain in iron the most delicate and faithful copy of a mold, and in the fusible alloy a clear-cut copy of a type. The modern dynamical theory of heat enables us to see that a perpetual motion would be procurable, if bodies which contract on solidifying had *not* their melting point raised by pressure, and *vice versa*.

Analogous to the fusion of a solid is its *solution* in a liquid, or the mutual conversion into liquids of two solids which are intimately mixed in powder. Here, also, we should expect actual energy in the shape of heat, to be used up in producing the potential energy of the fluid state; and, indeed, such is always the case. Such changes of arrangement destroy heat, or produce cold; but this in many cases is not the effect observed, as heat is generally developed by the *loss* of potential energy, if there be *chemical action* between the two substances. Hence, in general, the observed effect will be the difference of the heat *generated* by chemical action, and that *absorbed* in change of state.

If a quantity of pounded nitrate of ammonia (a very soluble salt) be placed in a vessel, an equal weight of water added, and the whole stirred for a minute or two with a test-tube containing water, the heat required for the solution of the salt will be abstracted from all bodies in contact with the solution, and the water in the test-tube will be frozen. In this sense, the compound is called a *freezing mixture*.

Of course the converse of this may be expected to hold, and latent heat to become sensible when a liquid becomes solid. As an example, when a saturated solution of sulphate of soda begins to deposit crystals of the salt, the temperature rises very considerably; and it is the disengagement of latent heat that renders the freezing of a pond a slow process, even after the whole of the water has been reduced nearly to the freezing-point.

Almost all that has been said on the subject of fusion is true of vaporization, with the change of a word or two. Thus, however much heat we may apply to a liquid, the temperature does not rise above the boiling-point. Heat, then, becomes *latent* in the act of vaporization, or rather is *converted into* change of state. It is found by experiment that 540 units of heat (each sufficient to heat a pound of water 1° C.) disappear in the conversion of a pound of water into steam. Hence a pound of steam at 100° C. is sufficient to raise 5.4 pounds of water from zero to the boiling-point.

There are at least three distinct ways in which heat is communicated, and these we will take in order.

First, as to conduction: Why is it that if one end of a poker and of a glass or wooden rod be put into a fire, we can keep hold of the other end of the latter much longer than we can of the former? The reason is, that heat is more readily transmitted in the iron from particle to particle, than it is in glass or wood. This is conduction. It is to be noticed, however, that in this experiment a great portion of the heat which passes along each rod is given off into the air by the surface. The mathematical theory of conduction has been most exquisitely investigated by Fourier, and after him by Poisson, but on the supposition that the rate at which heat passes from a warmer to a colder portion of a body is proportional to the *difference* of temperature. As most of the experiments which have been made with the object of ascertaining the *conductivity* (not *conductibility*, the erroneous word in common use) of different bodies have been made in this way, it is not surprising that our knowledge on this point is very meagre indeed. We know that silver conducts better than most other metals, and that the metals in general conduct better than other solids; but here our present information ends. It is satisfactory to know, however, that the defects of the old methods are now fully acknowledged, and that the important element of conductivity will shortly be accurately known for all important substances. Forbes has recently shown that the conductivity of iron diminishes as its temperature increases; and the same is probably true of other bodies. This invalidates the conclusions of the mathematical theories above mentioned, but the necessary corrections will be easily applied when the experimental data are completely determined.

In conjunction with their radiating power, the conductivity of bodies is most important as regards their suitableness as articles of clothing for hot or cold climates, or as materials for building or furnishing dwelling houses. We need but refer to the difference between linen and woollen clothing, or to the difference (in cold weather) of sensation between a carpet and a bare floor, in order to show how essential the greater or less conducting power of bodies is to our everyday comfort.

By radiation is understood the passage of heat, not from particle to particle of one body, but through air or vacuum, and even through solid bodies (in a manner, and with a velocity quite different from those of conduction) from one body to another. There can be no doubt whatever as to radiant heat being *identical* with light, differing from red light, for instance, as red light differs from blue—i. e., having longer waves than those corresponding to red light. This idea might easily have arisen during the contemplation of a body gradually heated. At first it remains dark, giving off only rays of heat; as its temperature increases, it gives us, with the heat a low red light, which, by the increase of the temperature, is gradually accompanied by yellow, blue, etc., rays, and the incandescent body (a lime-ball, for instance) finally gives off a light as white as that of the sun, and

which, therefore, contains all the colors of sunlight in their usual proportions. In fact there is great reason to believe that the sun is merely a mass of incandescent melted matter, and that the radiations it emits, whether called heat or light, merely differ in *quality*, not in *kind*. Taking this view of the subject at the outset, it will be instructive to compare the properties of radiant heat with those of light throughout.

Light, then, moves (generally) in straight lines. This is easily verified in the case of heat by the use of the thermo-electric pile and its galvanometer. Placing the pile *out* of the line from a source of heat to an aperture in a screen, *no* effect is observed; but deflection of the needle at once occurs when the pile is placed in the line which light would have followed if substituted for the heat.

A concave mirror, which would bring rays of light proceeding from a given point to a focus at another given point, does the same with heat, the hot body being substituted for the luminous one, and the pile placed at the focus. Heat, then, is *reflected* according to the *same laws* as light. A burning lens gives a capital proof of the sun's heat and light being subject to the same laws of *refraction*. When the solar spectrum is formed by means of a prism of rock-salt, the thermo-electric pile proves the existence of heat in all the colored spaces, increasing however, down to the red end of the spectrum, and attaining its maximum *beyond* the visible light, just as if heat were (as it *must* be) light with longer waves.

Some bodies, as glass, water, etc., transmit, when in thin plates, most of the light which falls on them; others, as wood, metal, colored glass, etc., transmit none or little. A plate of rock salt, half an inch thick, transmits 96 per cent. of the rays of heat which fall on it; while glass, even of a thickness of one-tenth of an inch, transmits very little. In this sense rock-salt is said to be *diathermanous*, while glass is said to be *adiathermanous*, or only partially diathermanous. Most of the simple gases, such as oxygen, hydrogen, etc., and *mixtures* of these, such as air, oppose very little resistance to the passage of radiant heat; but the reverse is the case with compound gases. Some experiments by Tyndall seem to show that the vapor of water is exceedingly *adiathermanous*. The question, however, cannot be considered as finally settled, since some of Tyndall's results are so startling as to require further research and confirmation.

Again, light can be *doubly refracted*, *plane polarized*, *circularly polarized*. All these properties have been found in heat by Principal Forbes.

The beautiful investigations of Stokes and Kirchoff on the solar spectrum have shown us that bodies, which most easily *absorb* light of a particular color, when heated, give off most freely light of that color; and it is easily shown by experiment, that those surfaces which absorb heat most readily, also radiate it most readily. Thus, it was found by Leslie, that when a tinned-iron cube full of boiling water had one side polished, another roughened, a third covered with lamp-black, etc., the polished side radiated little heat, the roughened more, while the blackened side radiated a very great quantity indeed. And again, that if we have (say) three similar thermometers, and if the bulbs be (1) gilded, (2) covered with roughened metal, (3) smoked, and all be exposed to the same radiation of heat, their sensibility will be in the order 3, 2, 1. A practical illustration of this is seen in the fact that a *blackened* kettle is that in which water is most speedily boiled, while a polished one keeps the water longest warm when removed from the fire. Again, if a willow-pattern plate be heated white-hot in the fire, and then examined in a dark room, the pattern will be reversed—a white pattern being

seen on a dark ground. This experiment of Stewart's is very remarkable, and virtually constitutes an anticipation of Kirchoff's results leading to the explanation of the fixed lines in the spectrum. It is this law of radiation and absorption that mainly gives rise to the superior comfort of white clothing to black in winter as well as in summer; radiating less in winter, it absorbs less in summer.

Much has been argued about the separate existence of *cold*, from such facts as these: A piece of ice held before the thermo-electric pile, produces an opposite deflection to the galvanometer to that due to a hot ball. If a freezing mixture be placed at one focus of a spheroidal mirror, and a thermometer with a blackened bulb at the conjugate focus, the latter will fall speedily, though very far off from the mixture. Now, the real explanation of such observations is to be found in what is called the "Theory of Exchanges," first enunciated by Prevost, and since greatly extended and carefully verified by Stewart, which is to this effect: "Every body is continually radiating heat in all directions, the amount radiated being (nearly) proportional to its own temperature." Hence the apparent radiation of cold in the experiments above mentioned is due to the fact of the pile or thermometer *radiating off more heat than it receives*, as its temperature is higher than that of the freezing mixture to which it is opposed. From this it is evident that any number of bodies left near each other, tend gradually to assume a common temperature. By this theory of exchanges, we explain the cold felt in sitting opposite a window in a frosty day, even when there is no draught.

A hot body cools faster in a current of air than in a still atmosphere of the same temperature, evidently because fresh supplies of the colder air are continually brought into contact with it. It is by convection mainly that heat is conveyed from particle to particle in liquids and gases. Thus, when a lamp is applied to the bottom of a vessel of water, the heat does not diffuse itself in the water as it would (by conduction) in a mass of metal, but the expansion of the heated water at the bottom rendering it lighter, bulk for bulk, than the superincumbent fluid, causes it to rise to the surface; and thus, by convection, the heat is diffused through the mass. Conduction, properly so-called, can scarcely be shown, even if it really exist, in liquids or gases, on this account. The tremulous appearance of any object, as seen by light which passes near a hot surface, as that of a boiler or a red-hot poker, is due to the convection of heat in the air, the warm current refracting light less than the cold air.

The sources of heat may be, so far as we know, ultimately reduced to two—chemical combination, and mechanical force; and, indeed, in all probability, the former is only a variety of the immensely different forms in which the latter is manifested.

Combustion is the term applied to the process of burning, which usually consists in the oxygen of the air uniting with the constituents of the combustible substance. Thus, the combustion of coal is due to the oxygen of the air passing into a state of chemical union with the carbon and the hydrogen of the coal, forming carbonic acid and water-vapor. Such chemical combinations are always accompanied by the production of more or less heat, as in the case of decaying wood and other vegetable matter; but it is only when the action is so rapid as to evolve intense heat accompanied by light, that the process is called burning or combustion. Though the gaseous oxygen has as much to do with the process as the more solid material, coal, wood, paper, or cloth, yet the latter is alone styled the *combustible* or *burning body*, whilst the oxygen is invariably named the *supporter of combustion*.

tion. A few substances burn at ordinary temperatures, such as phosphorus, which glows when exposed to the air; but the generality of substances, such as wood, coal, etc., require to be raised in temperature or be set fire to before they possess the power of combining with the oxygen of the air. The amount of heat given out by the various combustibles when burned, is capable of being measured, and is definite. The same weight of the same combustible invariably evolves the same amount of heat during its complete combustion; but different combustible substances give off different amounts of heat. The mode in which the heat evolved may be measured, is either (1) To observe the quantity of ice which a given weight of the combustible will melt when burning; (2) To notice the weight of water which the combustible will convert into steam; or (3) To estimate the number of pounds of water which the burning body will raise from 32° to 212° Fahrenheit. The last plan is the more easily managed and accurate.

Electricity.—This is the name used in connection with an extensive and important class of phenomena, and usually denoting either the unknown cause of the phenomena or the science that treats of them. Most of the phenomena in question are classed under the three chief heads of frictional electricity, galvanism and magneto-electricity.

Thales, about 600 B. C., refers in his writings to the fact that amber, when rubbed, attracts light and dry bodies. This was the only electric fact known to the ancients. The science of electricity dates properly from the year 1600 A. D., when Gilbert of Colchester published a book entitled “*De Arte Magnetica*,” in which he gives a list of substances which he found to possess the same property as amber, and speculates on magnetic and electric forces. He is the inventor of the word electricity, which he derived from the Greek word *electron*, amber. Otto von Guericke, burgomaster of Magdeburg, in his work “*Experimenta Nova Magdeburgica*” (1672), describes, among his other inventions, the first electric machine ever made, which consisted of a globe of sulphur turned by a handle, and rubbed by a cloth pressed against it by the hand. Hawksbee (1709) constructed a machine in which a glass cylinder, rubbed by the dry hand, replaced Guericke’s sulphur globe. Grey and Wehler (1729) were the first to transmit electricity from one point to another, and to distinguish bodies into conductors and non-conductors. Dufay (1733 to 1745) showed the identity of electrics and non-conductors, and of non-electrics and conductors, and was the first to discover the two kinds of electricity, and the fundamental principle which regulates their action. Between the years 1733 and 1744, much attention was given in Germany to the construction of electric machines. Up to this time, notwithstanding the inventions of Guericke and Hawksbee, the glass tube rubbed by a piece of cloth which Gilbert first introduced, was used in all experiments. Boze, a professor at Wittenberg, taking the hint from Hawksbee’s machine, employed a globe of glass for his machine, and furnished it with a prime conductor. Winkler, a professor at Leipsic, was the first to use a fixed cushion in the machine. The Leyden jar was (1746) discovered accidentally at Leyden by Muschenbroek; but the honor of the discovery has been contested also in favor of Cuneus, a rich burgess of that town, and Kleist, canon of the cathedral of Camin, in Pomerania. Franklin (1747) showed the electric conditions of the Leyden jar, and (1752) proved the identity of lightning and electricity by his famous kite experiment. This last was performed with the same object about the same time, and quite independently, by Romas of the town of Nerac, in France. In 1760 Franklin

made the first lightning conductor. Canton, Wilke and Æpinus (1753 to 1759) examined the nature of induction. Ramsden (1768) was the first to construct a plate machine, and Nairn (1780) a two fluid cylinder machine. The electrophorus was invented by Volta in 1775, and the condenser by the same electrician in 1782. In 1786 Galvani made the discovery which led to the addition of the new branch to the science which bears his name, and which now far exceeds the older branch in extent and practical value. In 1787, Coulomb, by means of his torsion-balance, investigated the laws of electric attraction and repulsion. In 1837, Faraday published the first of his researches on induction. Armstrong, in 1840, designed his hydro-electric machine.

The fundamental facts regarding frictional electricity may be thus stated: Bodies which do not conduct electricity, or non-conductors, are capable of electrical excitation from friction, and are, in consequence, termed electrics, and that conductors not so affected are called non-electrics. The *fundamental principles* of electricity are illustrated by the *electric pendulum*. A glass tube bent at right angles, so as to project horizontally, is placed on a convenient stand. On the hook in which its upper end terminates, a cocoon thread is hung, to the end of which a pith-ball is attached. The ball is thus doubly insulated by the glass and the silk thread. If a tube of glass be rubbed by a dry silk handkerchief, and brought near the ball, the ball is at first briskly attracted, and then as briskly repelled; and if the tube be then moved towards it, it moves off; keeping at the same distance from it. The ball being so affected, or charged, as it is called, a rod of shell-lac or of sealing wax, after being rubbed with flannel, attracts it, if possible, more briskly than before, and again sends it off exactly as the glass had done. If the glass tube be now again taken up and rubbed a second time, if necessary, the ball will act towards it as it did towards the sealing wax. The same series of attractions and repulsions would have taken place if we had begun with the sealing wax instead of the glass tube. We interpret this experiment in the following way: When glass is rubbed with silk, and the silk removed, it is charged with what is called positive electricity. The ball is attracted by it, and becomes on contact also charged with positive electricity, and is then repelled. When sealing wax is rubbed with flannel, and the flannel removed, it becomes charged with negative electricity, which is the counterpart of positive electricity, for it attracts the positively charged ball, and communicating its own electricity to it, finally repels it. From such an experiment as this, we conclude that bodies electrified either positively or negatively, attract neutral bodies and bodies affected with electricity of an opposite name to their own, but repel those affected with electricity of the same name; and that electricity can be communicated from one body to another by contact. For positive and negative (written also + and -), the terms vitreous and resinous are also employed, as glass and resin are the typical substances from which they may be obtained. Contact is not the only way in which electricity is communicated. We find, when we deal with larger bodies than the pith ball of the experiment, and sometimes even with it, that the passage of a *spark* between two bodies without contact communicates the electricity of the one to the other. The part played by the rubbers in the above experiment must not be overlooked. The silk handkerchief employed to rub the glass assumes the resinous or - electrical state, and the flannel rubber of the sealing wax the vitreous or +. This cannot, however, be clearly shown, as the experiment is performed, for the rubbers are in each case tightly embraced by the hand,

which neutralizes their peculiar electricity. We can perform our fundamental experiment in a way clearly to show this. Let us take for our rubbing and rubbed surfaces two india rubber balloons inflated with air (such as children play with), and hold them tightly one in each hand. They may be in all respects perfectly alike. Let us then rub them briskly on each other, and then hold the rubbed sides closely together. On bringing the two in contact near the pith ball, it remains indifferent to them; but if we pull them apart, and put one on each side of the pith ball, the ball plays actively between them, being attracted and repelled by each in turn. The fact of no attraction occurring when the balloons are together, shows that in the rubbing both electricities are generated in equal quantities, for they neutralize each other when brought near; and the fact that the balloons must be separated proves that all electric phenomena take place in an electric field, with positive electricity at its one termination, and negative electricity at its other. The non-conducting nature of the india rubber prevents the electricities finally neutralizing in contact, and disappearing by the hands when apart. It is also instructive that as force is exerted and work is done in pulling them apart, we have the equivalent of that work in the form of an electric field capable of doing work. The motion of the pith ball, and the heating caused by the tiny sparks which charge it, are evidences of the truth of the statement. It is again worthy of note that both balloons appear exactly alike, and yet they assume opposite electricities.

In most cases of friction, the nature of the rubbing and rubbed surfaces determines the kind of electricity which each assumes. Thus, if glass be rubbed by a cat's fur instead of silk, its electricity is — instead of +. In the following list, each body, when rubbed by any one preceding it, is negatively electrified; by any one succeeding it, positively: cat's fur, smooth glass, linen, feathers, wood, paper, silk, shell-lac, ground glass. When two pieces of the same material are rubbed together, the colder or smoother becomes positively excited. Metal filings rubbing against a plate of the same metal determine — electricity in themselves, and + electricity in the plate. When a white silk ribbon is rubbed by a black one of the same texture, the white one becomes +. A plate of glass becomes + when a stream of air is directed against it from a pair of bellows. The friction caused by steam of high tension issuing from a narrow pipe develops electricities in the steam and pipe which depend on the material of the latter. This fact has been turned to advantage by Armstrong in the construction of a boiler electrical machine of immense power.

There are two theories which have played an important part in the history of the science—the two-fluid theory of Dufay, and the one-fluid theory of Franklin. According to the former, matter is pervaded with two highly elastic imponderable electric fluids—one, the vitreous; the other, the resinous. These are supposed to repel themselves, but attract each other. Neutral bodies give no evidence of their presence, for they are neutralized the one by the other; but when by friction or other operation the fluids are separated, each body observes the attractions and repulsions of the fluid it happens to have. According to the latter, there is only one electric fluid which repels itself, but attracts matter. Friction determines a gain of the fluid to the positive, and a loss to the negative body. Faraday's theory of electric induction by contiguous molecules appears to be gaining ground. It explains satisfactorily how conductors and non-conductors are alike in kind; how the charge on a conductor can only reside at the boundary of the conductor and non-conductor, or—which is the same thing—the surface of

the conductor; how the charge resides in the dielectric; how the polarity of the galvanic circuit is effected; how a battery current originates in and effects chemical decomposition; and how the velocity of discharge is dependent on the conformation of the circuit."

Galvanism is that branch of the science of electricity which treats of the electric currents arising from chemical action, more particularly from that attending the dissolution of metals. It is sometimes called dynamical electricity, because it deals with current electricity, or electricity in motion, and is thus distinguished from frictional electricity, which is called statical in consequence of its investigating the electric condition of bodies in which electricity remains insulated or stationary. These terms, although in the main thus properly applied, are in all strictness applicable to both sciences. Frictional electricity, though small in quantity, can pass in a sensible current, and galvanic electricity, though small in tension, can be made to manifest the attractions and repulsions of stationary electricity. Thus the series of discharges which are transmitted in a wire connecting the prime conductor of a machine in action with the ground, possesses, though feebly, the characteristics of a galvanic current; and the insulated poles of a many celled galvanic battery, manifest before the current begins the electric tension of the friction machine.

Magneto-electricity includes all phenomena where magnetism gives rise to electricity.

Air.—Atmosphere is the name applied to the gaseous envelope which surrounds the earth. The existence of an atmosphere is to us a matter of vital importance. We owe to its influence the possibility of animal and vegetable life, the modifying and retaining of solar heat, the transmission of sound, the gradual shading of day into night, the disintegration of rocks, and the occurrence of weather phenomena. In consequence of the action of gravity, the atmosphere assumes the form of a spheroidal stratum concentric with the earth, and presses heavily on its surface. It exhibits, in common with all fluid bodies, the usual characteristics of hydrostatic pressure, but its internal condition differs from that of a liquid inasmuch as its particles repel each other, and can only be held in proximity by external force. From this circumstance, it follows that the volume of any portion of air varies much more under the influence of external pressure than that of an equal volume of water; hence, the stratum of air nearest the earth is denser than the strata in the upper regions, where, from their being subjected to the weight of a smaller mass of superincumbent air, the repulsive force of the particles has freer play.

That air possesses *weight*, is illustrated by the following simple experiment. If a hollow glass globe of five or six inches in diameter be weighed first, when filled with air, and then, after the air has been extracted from it by means of the air pump, it will, when thus exhausted, weigh sensibly less than it did before, and the difference of the two results will represent the weight of the quantity of air which has been withdrawn. It has been determined by Biot and Arago that 100 cubic inches of dry air, when the barometer is at 30 inches, and the thermometer at 60° Fahrenheit, weigh 31.074 grains. The law of Archimedes, that a body immersed in a fluid loses a part of its weight equal to the weight of the volume of fluid displaced by it, finds its application in the atmosphere, as well as in water. If a glass globe filled with air and closed be suspended at the extremity of the beam of a delicate balance, and be kept in equilibrium by a brass weight at the

other extremity, and if the whole be then placed under the receiver of an air-pump, and the air extracted, the equilibrium previously existing in air will be disturbed, and the larger body will become the heavier. The reason of this is, that when first weighed, they each lose as much of their own weight as that of the respective volumes of air displaced by them, and are therefore made buoyant, though in different degrees, the ball with the larger volume having the greater buoyancy. In a vacuum, they are deprived of this buoyancy, and the larger body, suffering the greater loss, becomes sensibly heavier than the other. In like manner, a balloon filled with heated air or hydrogen gas is lighter than the volume of air displaced by it. It is therefore forced upwards till it reaches a stratum of such density that the weight of the volume of air there displaced by it equals the weight of the balloon itself. In this stratum it will remain poised, or move horizontally with the currents to which it may be exposed.

In endeavoring to determine the *form* of the atmospheric envelope, it is necessary to bear in mind that, according to the law of fluid-pressure, in order to produce a state of equilibrium at the level of the sea, the pressure of the atmosphere must be equal at that level over the whole of the earth's surface. Gravity acts with less force on the air at the equator than on that at the poles, in consequence of the spheroidal form of the earth. It has there, in addition, to contend with the centrifugal force, which entirely fails at the poles, and which has a tendency to lighten the air by acting contrary to that of gravity. Hence we infer, that in order to produce the same pressure at the level of the sea, the atmospheric height at the equator must be greater than that at the poles, and that the atmosphere must therefore possess the form of an oblate spheroid, whose oblateness is considerably greater than that of the earth itself. The greater heat at the tropical regions must also have the effect of increasing the oblateness.

The *height* of the atmosphere has not yet been determined. That it must have a certain limit, is evident from the consideration that there must be a point at which gravity on the one hand, and centrifugal force and the repulsive action of the particles on the other, are poised, and beyond which the latter forces on balancing the former force, the aerial particles would be borne away from the earth. As, however, the law of the diminution of temperature, which materially affects the repulsive action, is unknown for the upper regions of the air, it is impossible to calculate the height of the atmosphere from the relations of these forces. From the observation of luminous meteors, it is inferred that it is at least 100 miles high. and that, in an extremely attenuated form, it may even reach 200 miles.

The *pressure* of the atmosphere is one of its most important properties. Its effect is exhibited in the action of the ordinary water-pump. The piston is fitted air-tight in its cylinder; and on being drawn up, creates a vacuum. The water within the pump being thus freed from pressure, while that outside of it is exposed to the pressure of a column of air reaching to the surface of the atmosphere, is at once forced up by reason of the weight of air which it must rise to balance. The ascent of the water takes place till the piston has reached the height of nearly 34 feet, from which we conclude that a column of air is equal in weight to a column of water of the same horizontal section, and of the height of nearly 34 feet. As mercury is 13.6 times heavier than water, a mercurial column freed from atmospheric pressure at the one extremity, and subjected to it at the other, is 13.6 times less in height than the column of water, or about 30 inches. From the more convenient size of this column, mercury has been adopted as the standard

for atmospheric pressure, and is employed in our ordinary barometers. A mercurial column of 30 inches in height, and one square inch in section, weighs 15 lbs. (more accurately, 14.73), which gives us the equivalent weight of a column of atmospheric air of the same section. The word atmosphere is often employed to express this weight or pressure on a square inch of surface, so that when we speak, in mechanics, of the pressure of steam on a boiler as amounting to three atmospheres, we mean a pressure of 45 lbs. on the square inch. The pressure on a square inch being thus ascertained, we have merely to multiply it by the number of square inches on the earth's surface to obtain the total weight of the atmosphere. It amounts to 11.67085 trillions of lbs.

Recent chemical researches give the following as the mean composition of 100 volumes and of 100 grains of dry air:

	Volumes.	Grains.
Nitrogen.....	79.02	76.84
Oxygen..	20.94	23.10
Carbonic acid.....	0.04	0.06
	100.00	100.00

Besides the substances just named, other gaseous matters occur, but in quantities so small as not sensibly to increase the bulk of the atmosphere, such as ammonia and ammoniacal salts, carburetted and sulphuretted hydrogen, carbonic oxide, sulphurous and sulphuric acid, nitric acid and perhaps iodine, the quantity and even the presence of which are affected by local and meteorological causes. Roughly speaking, then, dry air may be said to consist of four volumes of nitrogen, and one of oxygen, with a slight admixture of carbonic acid, and a mere trace of several other substances. As, however, the air of the atmosphere is never found dry, we must add to the constituents already named watery vapor, the amount of which is constantly changing, according to locality, weather, wind and temperature. It is stated that of 1,000 grains of atmospheric air, the proportion due to aqueous vapor varies from a minimum of four to a maximum of sixteen grains. By far the most active chemical constituent of the atmosphere is oxygen, to the agency of which are owing the existence of animal life, the maintenance of combustion, the rusting of metals, and the occurrence of several other chemical phenomena too numerous to be detailed. The nitrogen which forms the bulk of the atmosphere possesses few chemical properties of importance, but performs the important part of diluting the oxygen, which, if it occurred alone, would act with too great intensity. The presence of carbonic acid in the air is shown by the production of the white carbonate of lime in lime-water freely exposed to its influence. Carbonic acid is produced in all processes where carbonaceous matter unites itself with the oxygen of the air, such as in animal respiration, in combustion, in fermentation, in putrefaction, and similar processes. The green leaves of plants, on the other hand, possess, in presence of sunshine, the power of decomposing carbonic acid into its elements, absorbing the carbon for their own tissues, and restoring the oxygen to the atmosphere in its original purity. Between the processes above mentioned, on the one hand, and the action of plants on the other, the quantity of carbonic acid in the air is kept nearly constant. From the table it will be seen that 10,000 volumes of atmospheric air contain four volumes of carbonic acid. If it occurred in a much larger proportion, being poisonous, it would become dangerous to animal life; and if it occurred in a much less proportion, the vegetable world would lack its

requisite nourishment. The other substances, of which a trace is always or only sometimes found in atmospheric air, are difficult to detect in the air itself, but are generally found dissolved in rain-water, more especially in that which has fallen immediately after a long drought. Of these, by far the most important and widely diffused are ammonia and ammoniacal salts, which are of essential importance to the vegetable economy, because, dissolved in the rain, they furnish plants with the nitrogen required by them for the production of their flowers and fruit. Nitric acid is detected in the air after thunder-storms, sulphuretted hydrogen in the tainted air of sewers and such like places, and sulphurous and sulphuric acid only in the neighborhood of chemical or smelting works. A considerable quantity of carbonic oxide and carburetted hydrogen escapes unconsumed from our furnaces; and although the latter gas is in addition given off to the air in marshy and bituminous districts, the two occur in almost inappreciable quantity in the atmosphere.

In addition to its gaseous constituents, the atmosphere contains solid substances in a state of exceedingly fine division, the presence of which is revealed in the sunbeam. Many of these minute particles, being the seeds or germs of plants and animals, must exert an important influence on the organic substances on which they may finally settle, inducing in many of them the conditions of disease or putrefaction.

Water.—In a state of purity, at the ordinary temperature of the air, water is a clear, colorless, transparent liquid, perfectly neutral in its reaction, and devoid of taste or smell. At a temperature below 32° it freezes, crystallizing in various forms derived from the rhombohedron and six-sided prism. It appears from the researches of Arago and Fresnel, that notwithstanding the gradual dilatation of water below 39° , its refractive power on light continues to increase regularly, as though it contracted. Its density at 60° , and at the level of the sea, is taken at 1.000, and forms the standard of comparison for all solids and liquids, hydrogen being similarly taken as the standard of comparison for gases and vapors. Distilled water is 815 times heavier than air; a cubic inch weighs, in air at 62° , with the barometer at thirty inches, 252.458 grains, and *in vacuo*, 252.722 grains, the grain being 1/7000 of the avoirdupois pound. For all practical purposes, water may be considered as incompressible; but very accurate experiments have shown that it does yield to a slight extent when the pressure employed is very great; the diminution of volume for each atmosphere of pressure being about fifty-one millionths of the whole. Water evaporates at all temperatures, and under the ordinary pressure of the atmosphere, boils at 212° , passing off in the form of steam, which, in its state of greatest density at 212° , compared with air at the same temperature, and with an equal elastic force, has a spec. grav. of 0.625. In this condition it may be represented as containing, in every two volumes, two volumes of hydrogen and one volume of oxygen.

Water is the most universal solvent with which the chemist is acquainted, and its operations in this respect are equally apparent, although on very different scales, on the surface of the globe and in the laboratory. This solvent action is usually much increased by heat, so that a hot aqueous saturated solution deposits a portion of the dissolved matter on cooling. Some substances are so soluble in water, that they extract its vapor from the atmosphere and dissolve themselves in it. Moreover, when water is heated in a strong closed vessel to a temperature above that of the ordinary

boiling-point, 212° , its solvent powers are much increased. All gases are soluble in water, but water dissolves very unequal quantities of different gases, and very unequal quantities of the same gas at different temperatures. Some gases are so extremely soluble in this fluid, that it is necessary to collect them over mercury. For example, at 32° one volume of water dissolves somewhat less than 1-50th of its volume of hydrogen, and exactly 1-50th of its volume of nitrogen, while it dissolves 506 and 1,050 volumes of hydrochloric acid and ammonia gases; and while at 32° water dissolves 1-8 times its volume of carbonic acid, it dissolves only half that volume of the gas at 60° .

It is less than a century since the ancient view, that water was one of the four elements, has ceased to be believed in. It is now known that it is a compound of oxygen with hydrogen in the proportion of one equivalent of each. Hence its symbol is HO, and its combining number 9. When converted into vapor, 9 grains of steam occupy the bulk of 8 grains of oxygen at the same temperature; hence the combining volume of aqueous vapor is equal to 2, if the combining volume of oxygen be taken as 1.

Wind.—Wind is air in motion. All wind is caused, directly or indirectly, by changes of temperature. Suppose the temperature of two adjacent regions to become, from any cause, different, the air of the warmer, being lighter, will ascend and flow over on the other, whilst the heavier air of the colder region will flow in below to supply its place. Thus, then, a difference in the temperature of the two regions gives rise to two currents of air—one blowing from the colder to the warmer along the surface of the earth, and the other, from the warmer to the colder, in the upper regions of the atmosphere; and these currents will continue to blow till the equilibrium be restored.

Winds are classed into *Constant*, *Periodical* and *Variable Winds*.

The trade wind is a constant wind, and is thus explained: When the part of the earth's surface which is heated is a whole zone, as in the case of the tropics, a surface-wind will set in towards the heated tropical zone from both sides, and uniting will ascend, and then separating, flow as upper currents, in entirely opposite directions. Hence, a surface current will flow from the higher latitudes towards the equator, and an upper-current towards the poles. If, then, the earth were at rest, a north wind would prevail in the northern half of the globe, and a south wind in the southern half. But these directions are modified by the rotations of the earth on its axis from west to east. In virtue of this rotation, objects on the earth's surface at the equator are carried round toward the east, at the rate of 17 miles a minute. But as we recede from the equator, this velocity is continually diminished; at lat. 60° it is only eight and one-half miles a minute, or half of the velocity at the equator; and at the poles it is nothing. A wind, therefore, blowing along the earth's surface to the equator, is constantly arriving at places which have a greater velocity than itself. Hence, the wind will lag behind, that is, will come up against places towards which it blows, or become an east wind. Since, then, the wind north of the equator is under the influence of two forces—one drawing it south, the other drawing it west—it will, by the law of the composition of forces, flow in an intermediate direction, that is, from north-east to south-west. Similarly, in the southern tropic, the wind will blow from south-east to north-west.

Land and sea breezes are the most general of the periodical winds.

These winds are caused during the day, by the land getting more heated than the sea, consequently the air over it ascends, and the cool air from the sea flows over on the land to supply its place; and during night, by the temperature of the land falling below that of the sea, and the air becoming thereby heavier and denser, flows over the sea as a land breeze.



WIND CLOUD.

Variable winds depend on purely local or temporary causes, such as the nature of the ground, covered with vegetation or bare; the physical configuration of the surface, level or mountainous; the vicinity of the sea or lakes, and the passage of storms. Storms are sudden and violent winds, resembling whirlwinds, hereafter treated,

Whirlwinds and Waterspouts.—Whirlwinds seldom continue longer than a minute at any place, and sometimes only a few seconds; their



THE SIMOON.

breadth varies from a few yards to nearly a quarter of a mile; during their short continuance, the changes of the wind are sudden and violent; and the barometer is not observed to fall. The direction of the eddy of the whirlwinds, especially when the diameter is very small, differs from the rotation of winds in a storm, in that it may take place either way—right to left, or left to right—according to the direction of the stronger of the two winds which give rise to the whirlwind. Thus, suppose it to arise from

a north wind blowing side by side with a south wind, and to the west of it, then, if the north wind be stronger, the whirl will be north, west, south, and east; but it will be in a contrary direction if the south wind be the stronger. Whirlwinds often

originate within the tropics during the hot season, especially in flat sandy deserts; these becoming unequally heated by the sun, give rise to ascending columns of heated air. In their contact with each other, the ascending currents result in eddies, which draw up with them large clouds of dust, and the whole is borne forward by the wind that may happen to be blowing at the time. This is the origin of the *dust whirlwinds* of India. These dust-storms are frequent in dry warm regions; and in the case of the *Simoon*, which may be regarded as a succession of



WATERSPOUTS.

such whirlwinds, they appear on a scale of the most appalling grandeur. Extensive fires, such as the burning of a prairie, and volcanic eruptions, also cause whirlwinds; by the conflicting currents of heated air they occa-

sion; and these, as well as the whirlwinds already mentioned, are generally accompanied with heavy rains, hail and electrical displays.

Waterspouts are whirlwinds occurring on the sea or on lakes. When fully formed, they appear as tall pillars of cloud stretching from the sea to the sky, whirling round their axes, and exhibiting the progressive movement of the whole mass precisely as in the case of the dust whirlwind. The sea at the base of the whirling vortices is thrown into the most violent commotion, resembling the surface of water in rapid ebullition. It is a popular fallacy that the water of the sea is sucked up in a solid mass by waterspouts, it being only the spray from the broken waves which is carried up. Observations of the rain gauge conclusively prove this.

Dew.—For any assigned temperature of the atmosphere, there is a certain quantity of aqueous vapor which it is capable of holding in suspension at a given pressure. Conversely, for any assigned quantity of aqueous vapor held in suspension in the atmosphere, there is a minimum temperature at which it can remain so suspended. This minimum temperature is called the dew-point. During the day time, especially if there has been sunshine, a good deal of aqueous vapor is taken into suspension in the atmosphere. If the temperature in the evening now falls below the dew-point, which after a hot and calm day generally takes place about sunset, the vapor which can be no longer held in suspension is deposited on the surface of the earth, sometimes to be seen visibly falling in a fine mist. This is one form of the phenomenon of dew, but there is another. The surface of the earth, and all things on it, and especially the smooth surfaces of vegetable productions, are constantly parting with their heat by radiation. If the sky is covered with clouds, the radiation sent back from the clouds nearly supplies an equivalent for the heat thus parted with; but if the sky be clear, no equivalent is supplied, and the surface of the earth and things growing on it become colder than the atmosphere. If the night also be calm, the small portion of air contiguous to any of these surfaces will become cooled below the dew-point, and its moisture deposited on the surface in the form of dew. If this chilled temperature be below 32° Fahrenheit the dew becomes frozen, and is called *hoar-frost*.

Rain.—At a given temperature, air is capable of containing no more than a certain quantity of aqueous vapor invisibly dissolved through it, and when this amount is present, it is said to be saturated. Air may at any time be brought to a state of saturation by reducing its temperature; and if it be cooled below this point, the whole of the vapor can now no longer be held in suspension, but a part of it passing from the gaseous to the liquid state, will be deposited in dew, or float about in the form of clouds. If the temperature continues to fall, the vesicles of vapor that compose the cloud will increase in number, and begin to descend by their own weight. The largest of these falling fastest, will unite with the smaller ones they encounter in their descent, and thus drops of rain will be formed whose size will depend on the thickness and density of the cloud. The point to which the temperature of the air must be reduced in order to cause a portion of its vapor to form cloud or dew, is called the dew-point.

Hence, the law of aqueous precipitation may be stated: Whatever lowers the temperature of the air at any place below the dew-point, is a cause of rain. Various causes may conspire to effect this object, but it is chiefly brought about by the ascent of the air into the higher regions of the atmos-

phere, by which, being subjected to less pressure, it expands, and in doing so, its temperature falls. Ascending currents are caused by the heating of the earth's surface, for then the superincumbent air is also heated and consequently ascends by its levity. Air currents are forced up into the higher parts of the atmosphere by colder, drier, and therefore heavier wind cur-



RAIN CLOUD.

rents getting beneath them, and thus wedgeways thrusting them upwards; and the same result is accomplished by ranges of mountains opposing their masses to the onward horizontal course of the winds, so that the air, being forced up their slopes, is cooled, and its vapor liberated in showers of rain or snow.

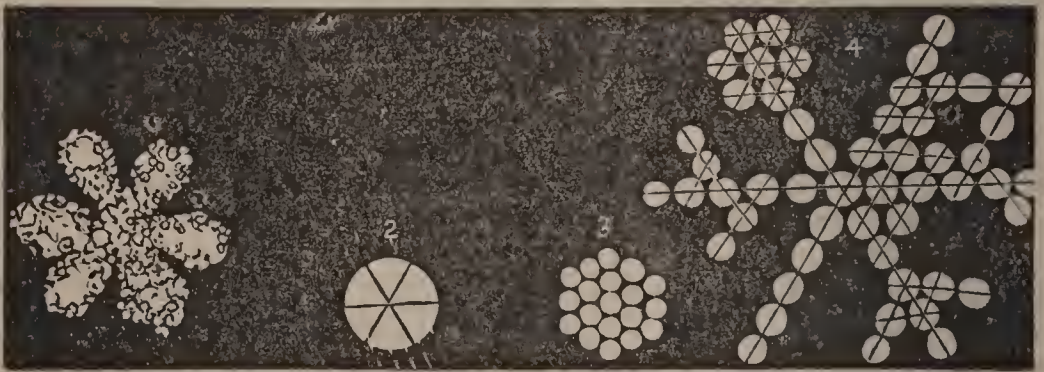
Snow.—Snow is the frozen moisture which falls from the atmosphere when the temperature is 32° or lower. It is composed of crystals, usually in the form of six-pointed stars, of which about 1,000 different kinds have been already observed, and many of them figured. These numerous forms have been reduced to the following five principal varieties: 1. Thin plates, the most numerous class, containing several hundred forms of the rarest



SNOW CLOUD.

and most exquisite beauty. 2. A spherical nucleus or plane figure studded with needle-shaped crystals. 3. Six or more rarely three-sided prismatic crystals. 4. Pyramids of six sides. 5. Prismatic crystals, having at the ends and middle thin plates perpendicular to their length. The forms of the crystals in the same fall of snow are generally similar to each other. The crystals of hoar-frost being formed on leaves and other bodies disturb-

ing the temperature, are often irregular and opaque; and it has been observed that each tree or shrub has its own peculiar crystals. Snow-flakes vary from an inch to 7-100ths of an inch in diameter, the largest occurring when the temperature is near 32° , and the smallest at very low temperatures. As air has a smaller capacity for retaining its vapor as the temperature sinks, it follows that the aqueous precipitation, snow or rain, is much less in polar than in temperate regions. The white color of snow is the result of the combination of the different prismatic rays issuing from the *minute* snow crystals. Pounded glass and foam are analogous cases of the prismatic colors blending together and forming the white light out of which they had been originally formed. It may be added that the air contained in the crystals intensifies the whiteness of the snow. It is from ten to twelve times lighter than an equal bulk of water. From its loose texture, and its containing about ten times its bulk of air, it is a very bad conductor of heat, and thus forms an admirable covering for the earth from the effects of radia-



SNOW CRYSTALS.

tion—it not unfrequently happening, in times of great cold, that the soil is 40° warmer than the surface of the overlying snow.

Hail.—The word hail, in English, is unfortunately used to denote two phenomena of apparently different origin. In French, we have the terms *grêle* and *gésil*—the former of which is hail proper; the latter denotes the fine grains, like small shot, which often fall in winter, much more rarely in summer, and generally precede snow. The cause of the latter seems to be simply the freezing of rain drops as they pass in their fall through a colder region of air than that where they originated. We know by balloon ascents and various other methods of observation, that even in calm weather different strata of the atmosphere have extremely different temperatures, a stratum far under the freezing point being often observed between two others comparatively warm.

But that true hail, though the process of its formation is not yet perfectly understood, depends mainly upon the meeting of two nearly opposite currents of air—one hot and saturated with vapor, the other very cold—is rendered pretty certain by such facts as the following: A hailstorm is generally a merely local phenomenon, or at most, ravages a belt of land of no great breadth, though it may be of considerable length. Hailstorms occur in the greatest perfection in the warmest season, and at the warmest period of the day, and generally are most severe in the most tropical climates. A fall of hail generally *precedes*, sometimes accompanies, and rarely, if ever, follows a thunder shower. A common idea, which has found

its way, as many popular prejudices continually do, into scientific treatises, assigns electricity as the origin of hail. But all observation, rightly interpreted, seems to show that electricity and hail are *results* of the same combination of causes.

When a mass of air, saturated with vapor, rising to a higher level, meets a cold one, there is, of course, instant condensation of vapor into ice by the cold due to expansion; at the same time, there is generally a rapid production of electricity, the effect of which upon such light masses as small hailstones is to give them in general rapid motion in various directions successively. These motions are in addition to the vortex motions or eddies, caused in the air by the meeting of the rising and descending currents. The small ice-masses then moving in all directions impinge upon each other sometimes with great force, producing that peculiar rattling sound which almost invariably precedes a hail shower. At the same time, by a well known property of ice (*Regelation*), the impinging masses are frozen together; and this process continues until the weight of the accumulated mass enables it to overcome the vortices and the electrical attractions, when it falls as a larger or smaller hailstone. On examining such hailstones, which may have any size from that of a pea to that of a walnut, or even an orange, we at once recognize the composite character which might be expected from such a mode of aggregation. Hailstones are reported to have fallen in tropical countries sometimes as large as a sheep, sometimes as large as an ox, or even an elephant! But it is probable that the aggregation in these cases was produced by regelation at the surface of the earth, when a series of large masses had impinged on each other, having fallen successively on the same spot. Whether this be the true explanation or no, it is certain that in British India, at the warmest season, hailstones have remained of considerable size for many days after their fall.

The Tides.—It has long been admitted that the tides, or the flowing and ebbing of the waters of the ocean, is caused by the moon; but this general theory admits of some modifications, or explanations. The attractive power of the sun is felt by the ocean; and high winds serve to increase or retard the rise and fall of the sea. The relative distances of the moon, at different times, are also to be considered, in accounting for different heights of the tides. The sun and moon exert an influence on our globe, by attraction, which is found to exist in all bodies. The force of this attraction, in such large bodies of matter as the sun and moon, is very great. The sun being far the largest of these bodies, would attract the earth in a much greater degree than the moon does, except that the latter is but a small distance from our globe, compared to the sun. When the sun and moon are in the same line, as to the earth, their combined influence is greater than that of either separate. And when the moon is at her quarter, as it is called, or farthest from the line from the sun to the earth, then the influence of the moon on the earth is less than in a different position. And then the tides do not flow so high, or are not so powerfully attracted by the moon; the attraction of the sun being to a different direction, or at a different part of the earth (for the attraction is perpendicular, or operates in straight lines).

The tyro is ready to ask, how there are two high tides in twenty-four hours. He sees by the above theory, that when the moon is at the meridian of any place (or rather a little later, unless other causes are in operation), the waters rise to the highest, at such place, by the moon's attraction. But

the difficulty is, as to another high tide directly on the opposite side of the earth. The moon attracts the earth, as well as the ocean, though not with so great apparent effect. The water of the sea is more easily affected. The whole earth is attracted by the moon; and thus the water of the ocean farthest from the moon, or on the opposite side of the earth, is drawn towards the moon, and leaves the water less attracted; which, in effect and appearance, rises higher, than in a state, where no attraction was felt on the earth or ocean. Thus there is a high tide on the side of the earth opposite to the moon, as well on the side next the moon, and nearly where the moon is in the meridian. In the one case, the water is attracted (being lighter than the earth) towards the moon, and rises to the highest point; and in the other, the whole earth is attracted towards the moon, and the water opposite to and farthest from the moon is left behind (as it were) and rises higher, compared to the earth near it, than it would otherwise appear.

But there are other considerations to be noticed in explaining the phenomenon of the tides. We have said that the highest tides happen at the new and full moon, when the sun and moon are in a line with the earth; but the waters do not yield instantly to the action exerted upon them, nor cease their motion caused by the attraction of the moon, at the moment the moon is in the meridian; the influence exerted continues to operate, or the effect continues. Thus the spring tides occur about a day and a half after the time indicated. For a similar reason, the real time of high water, in daily tides, occurs nearly three hours after the moon passes the meridian. The motion given to the waters of the ocean by the attraction of the moon, continues after the attraction has operated. An impetus is given which causes the water to move for some time after the cause of the motion ceases. This is agreeable to the general laws of matter and motion.

Pliny noticed the phenomenon of the tides eighteen centuries ago, and considered the cause to be the attraction of the sun and moon. Galileo and Kepler wrote on the subject three hundred years since, and Newton afterwards. His theory is generally adopted, and he shows that in a system of three bodies, the motion of one about another, and relative to the latter, is disturbed and irregularities produced, by the difference of the attractive forces of the sun on the earth and moon.

Earthquakes.—The term earthquake is that which is applied to any tremor or shaking of the solid crust of the earth. It is well known that the surface of the globe is never free from sensible evidence of the continued operation of earthquake agency—that in some quarter or another tremors or slight shakings are always taking place. When these are of a serious nature, whole cities have been destroyed; fertile districts, with all their fruit and grain, have been laid waste; and enormous masses of human beings have lost their lives. No less than 60,000 perished in the great Lisbon earthquake; while in that of Calabria, in the end of the last century, 40,000 were destroyed. It is estimated that as many as 13,000,000 of the human race have thus perished.

No portion of the earth's surface is exempt from the influence of earthquakes. Nor is the bed of the ocean exempt; records of many subaqueous earthquakes exist, taken by vessels at sea, sometimes passing over the point of greatest disturbance at the moment of the shock. In like manner earthquakes have been active at every period of the earth's existence, breaking up its solid crust, elevating or depressing its surface, and doing as much as any other single agent to bring it into its present condition. They have

been probably at some periods more active than at others, just as we find that some districts are now more liable than others to their visitation.

The phenomena connected with earthquakes have been variously described. Many writers refer to appearances in the heavens, or changes in the atmosphere, which to them seem to have some connection with the catastrophes they narrate. They tell of irregularities in the seasons preceeding or following the shock, of sudden gusts of wind interrupted by sudden calms, of violent rains at unusual seasons, or in countries where such phenomena are almost unknown, of a reddening of the sun's disc, of a haziness in the air often continued for months, and similar phenomena. But these are so irregular in their appearance, and have been so seldom observed associated with more than a single earthquake, that, in the absence of any decided reason to the contrary, there seem good grounds for believing they have no real connection with the earthquake. It is different with underground noises, which frequently preceed, accompany, or succeed the occurrence of earthquakes, or some of the shocks of them. They are undoubtedly intimately connected with the shock, yet earthquakes occur, even of the greatest violence, which are unaccompanied by any sound whatever. Different descriptions have been given of these subterranean noises. In some earthquakes, they are likened to chains pulled about, increasing to thunder; in others, the sound is like the rumbling of carriages, growing gradually louder, until it equals the loudest artillery; or like heavy wagons running away upon a road; or distant thunder; or like the hissing produced by the quenching of masses of red-hot iron in water.

All theorists are agreed as to the connection between volcanoes and earthquakes; that they are produced by the same subterranean agency. The existence of molten matter in the interior of the earth is the starting-point in all theories, but a complete and satisfactory solution of the entire problem yet remains to be given.

Whirlpools.—A whirlpool is a circular current in a river or sea, produced by opposing tides, winds, or currents. It is a phenomenon of rare occurrence on a large scale, but illustrations in miniature may be noticed in the eddies formed in a river by means of obstacles or deflections. The Maelstrom, the most famous whirlpool in the world, is situated on the Norwegian coast, between Moskoe and Moskenas, two of the Loffoden Isles. The tremendous current that rushes between the Great West Fjord and the outer ocean, through the channels between the Loffoden Isles, creates many other dangerous currents, such as the Galstrom, Napstrom, etc.; but these are not to be compared with the famous Maelstrom. The current runs for six hours from north to south, and then six hours from south to north, producing immense whirls. The depth of the water has been ascertained to be about 20 fathoms, while immediately to the west of the straits the soundings are from 100 to 200 fathoms. The whirlpool is greatest at high or low water; and when the wind blows directly against the current, it becomes extremely dangerous, the whole sea for several miles around being so violently agitated that no boat can live in it for a moment. In ordinary circumstances, it may be traversed even across the center without apprehension. The stories of ships, whales, etc., being swallowed up in the vortex, are simply fables; at the same time, there can be no doubt that a ship, once fairly under the influence of the current, would certainly either founder or be dashed upon the rocks, and whales have often been found stranded on the Flagaadt coast from the same cause.

LAW FOR THE MASSES.

[This department is made up of a series of extracts, republished by permission of the publisher, from a valuable and comprehensive work entitled "How to BE YOUR OWN LAWYER," a complete instructor for everybody in all the ordinary legal affairs of life, adapted to every State and Territory. The book is a large 12mo of more than 500 pages, neatly bound in cloth. Its price is \$1.50, and it is published by M. T. RICHARDSON, Nos. 21 to 27 New Chambers St., New York.]

Bonds.—A bond is any writing under seal in which a debt or obligation is acknowledged, or in which the maker shows that he intends to bind himself to the payment of a fixed sum of money.

The person making a bond is called the obligor.

The person to whom it is made is called the obligee.

No particular words are required, provided the intention of the parties can be learned from the instrument.

The words "Held and firmly obliged" are usually used.

The obligor has the benefit of the doubt in all cases where the intention of the parties is not clear, as the condition of the bond is considered the agreement and assent of the obligee and made for the benefit of the obligor.

No immaterial alteration of a bond would make it void, but it is advisable to make no alterations after it has been signed and sealed, as it might give rise to a suit.

Many suits arise from the difficulty in deciding whether the sum mentioned in the condition of the bond is to be considered "a penalty" or "liquidated damages." If it is regarded as a penalty, the court will reduce it to the actual amount of damages suffered; but if it is regarded as liquidated damages (damages which have been agreed upon at the time of drawing the bond), the court will not interfere if the sum named is not excessive, but will allow full payment to be enforced.

If the amount is to be a penalty, the words "penalty or forfeit" should be used; but if liquidated damages are intended, it should be stated that the parties have agreed to consider the sum mentioned in the condition as liquidated damages, and all words such as "penalty" and "forfeiture" or any reference to them, should be omitted.

The intention of the parties as to whether it was intended to be considered as a penalty or liquidated damages, even though either term is used, is to be learned from the surrounding circumstances and the bond itself.

The first part of the bond is considered the obligatory part, and is explained by the condition.

A bond being under seal is not barred by the Statute of Limitations until the lapse of twenty years.

The surety to a bond is under the same obligation to the obligee as is the obligor. If any alteration is made in the instrument without the knowledge or consent of the surety, he will be freed from his liability.

A bond should be entirely finished before execution and delivery.

If a surety does not wish to be bound unless some other person or persons sign, he should state that he executed it on this condition; the bond should make mention of this fact.

A bond will be considered valid when it conforms substantially to what is required by the statutes, and does not vary in any manner to the prejudice of the person for whose benefit it is to be given.

1.—COMMON FORM OF BOND FOR PAYMENT OF MONEY.

Know all men by these presents, that I, A. B., of the town of _____, in the county of _____, and State of _____, am held and firmly bound unto C. D., of the said town, in the sum of _____ dollars [inserting the penal sum, which is commonly double the amount of the principal sum intended to be secured], lawful money of the United States, to be paid the said C. D., his executors, administrators, or assigns, for which payment well and truly to be made I do bind myself, my heirs, executors, and administrators, firmly by these presents.

Sealed with my seal, and dated the _____ day of _____, 18 _____.

The condition of this obligation is such, that if the above bounden A. B., his heirs, executors, and administrators, or any of them, shall well and truly pay, or cause to be paid, unto the above-named C. D., his executors, administrators, or assigns, the just and full sum of _____ dollars [insert the principal to be secured], with interest thereon at the rate of _____ per cent. per annum, on the _____ day of _____, which will be in the year one thousand eight hundred and _____, without any fraud or other delay, then this obligation is to be void, otherwise to remain in full force and virtue.†

A. B. [Seal.]

Signed, sealed, and delivered in the presence of
[Names of witnesses.]

2.—BOND WITH INTEREST CLAUSE GIVEN WITH A MORTGAGE.

[Use Form 1 as far as †, then as follows:]

And it is hereby expressly agreed, that, should any default be made in the payment of the said interest, or of any part thereof, on any day whereon the same is made payable, as above expressed, and should the same remain unpaid and in arrear for the space of _____ days, then and from thenceforth—that is to say, after the lapse of the said _____ days—the aforesaid principal sum of _____ dollars, with all arrearage of interest thereon, shall, at the option of the said C. D., or his executors, administrators, or assigns, become and be due and payable immediately thereafter, although the period first above limited for the payment thereof may not then have expired, anything hereinbefore contained to the contrary thereof in anywise notwithstanding.

A. B. [Seal.]

Signed, sealed, and delivered in the presence of
[Names of witnesses.]

3.—BOND WITH INSURANCE CLAUSE.

[Use Form 1 as far as †, then as follows:]

And it is expressly agreed by and between A. B. and C. D., the parties to these presents, that the said A. B. shall and will keep the buildings erected and to be erected upon the lands above conveyed, insured against loss and damage by fire, by insurers, and in an amount approved by the said C. D., and assign the policy and certificates thereof to the said C. D.; and in default thereof, it shall be lawful for the said C. D. to effect such insurance, and the premium and premiums paid for effecting the same shall be a lien on the said mortgaged premises, added to the amount of the said bond or obligation, and secured by these presents, and payable on demand with interest at the rate of _____ per cent. per annum.

In witness whereof the said A. B. has hereunto set his hand and seal this _____ day of _____, 18 _____.

[Signature.] [Seal.]

Signed, sealed, and delivered in the presence of
[Signature of witness.]

Mortgages.—A mortgage is a conveyance of an estate or property by way of pledge for the security of a debt, and to become void on the payment of it. A mortgage of real property is one form of a lien upon it to secure the performance of some obligation, generally the payment of money.

All kinds of personal and real property which are capable of absolute sale may be the subject of a mortgage.

Any conveyance of land intended by the parties at the time of making it to be security for the payment of money or the doing of some specified act, is a mortgage.

Mortgages are of two kinds, legal and equitable.

A legal mortgage is in form a deed of land with a condition that if a certain sum of money be paid, or services be rendered, the deed shall be void. The condition is called the defeasance.

An equitable mortgage is a lien upon real estate of such a character that it is recognized in equity as a security for the payment of money, and is treated as a mortgage. Such a mortgage may arise by a deposit of the title deeds, and by an agreement to execute a mortgage, by proof that a deed, absolute on its face, was intended as a mortgage. The lien of vendor for unpaid purchase money is also an equitable mortgage.

The mortgage should have all the requisites of a deed; that is, it should be signed, sealed, and delivered.

It should be witnessed, acknowledged, and recorded. The mortgage is security for the payment of money. The debt for which the mortgage is given is the principal thing; consequently, if the debt is sold, the mortgage passes with it.

The party giving the mortgage is called the mortgagor; he to whom it is given the mortgagee.

A power of sale, in case of default in payment of interest or an instalment, is usually inserted, which enables the mortgagee to enforce payment.

Mortgages are made with or without a personal promise to pay the debt. Where no personal promise in writing is made, the mortgagor is not personally liable for the sum secured; the mortgage being in such case only a lien on the land.

Mortgages are frequently made to secure a contingent liability or future advances. A mortgage given for such purpose should state that fact.

A covenant is usually inserted in a mortgage to pay the debt, and a bond or note is given for it, which fact is mentioned in the mortgage, and it is stated in the mortgage that it is given in addition to the personal security. It is common to provide, in case buildings are on the premises, that the mortgagor shall keep them insured and assign the policy to the mortgagee. It is usual also to insert what is called an interest clause, which states that if interest remains unpaid for a certain number of days after it falls due, the mortgagee may elect to require payment of the principal at once.

For the better security of the mortgagee, he should require the wife of the mortgagor to join in the execution of the mortgage. It is not necessary that the wife of the mortgagor join in the execution of a mortgage for the purchase money. Mortgages should be acknowledged or proved the same as deeds in order to be recorded.

The mortgage can be assigned. The assignee then stands in the position of the mortgagee. The assignee of the mortgage should get a statement from the mortgagor as to the validity of the mortgage and the amount due.

The assignee should give notice of the assignment to the mortgagor, and should record his assignment. If the mortgagor should make two assign-

ments, the first recorded, if taken without knowledge of the previous assignment, would have the preference. The assignee may himself assign. A mortgage may be discharged by a release of the debt; by payment of the debt, by a tender of the mortgage debt on the day that it is due, even though the money is not accepted, by the holder of the mortgage acquiring title to the property, by the expiration of twenty years from the time the mortgage is due or from the time of last payment.

The mortgagor on payment of the mortgage should obtain a satisfaction piece from the mortgagee and have it recorded.

If a mortgagor places two mortgages on the same property, the first recorded, if taken without knowledge of the previous mortgage, would have the preference. For example: If A mortgages his property to B, and subsequently mortgages the same property to C, who, without knowledge of the previous mortgage, records his mortgage, C's lien on the property will be prior to that of B.

The mortgagor usually pays for drawing the mortgage and searching the title. The mortgagee should have the mortgage recorded immediately after the execution and delivery of it.

Chattel Mortgage—A chattel mortgage is a mortgage of personal property. It is a transfer of the title to chattels, and is given as security for a debt or liability.

It is given upon condition that the transfer shall be void if the debt is paid or discharged. If the mortgagor makes default in the payment of the debt at the time agreed upon, the mortgagee becomes the absolute owner, and may take possession of the property. The mortgagor has a right to redeem the property unless there has been a sale, in which case the right is lost.

The mortgage states the liability or the debt to be secured. The property mortgaged should be so described as to enable it to be identified. It is usual to insert a description of the property in the schedule annexed, and referred to in the mortgage. The property generally remains in the possession of the mortgagor until default in payment of the debt.

The mortgagee, for his own protection, should file his mortgage if the mortgagor retains possession of the property. If he fails to file his mortgage, and the mortgagee subsequently sells or mortgages the same property to another, who is ignorant of the existence of the previous mortgage, he loses his lien on the property. The mortgage, or a true copy thereof, must be filed in the office of the clerk of the town where the mortgagor resides. If the mortgagor is out of the State it should be filed with the clerk of the town where the property is located.

In New York every mortgage ceases to be valid as against creditors or subsequent purchasers, or mortgagees in good faith, after the expiration of one year from the filing thereof, unless within thirty days next preceding the expiration of the said term of one year, a true copy of such mortgage, together with a statement exhibiting the interest of the mortgagee in the property thereby claimed by him by virtue thereof, is filed in the office of the clerk of the town where the mortgagor shall then reside.

SHORT FORM OF MORTGAGE.

This indenture, made the day of in the year one thousand eight hundred and between A. B., of in the county of and State of of the first part, and C. D., of in the said county, of the second part, witnesseth: That the said party of the first part, for and in con-

sideration of the sum of dollars, grants, bargains, sells, and confirms unto the said party of the second part, and to his heirs and assigns, all [here insert description], together with all and singular the hereditaments and appurtenances thereunto belonging or in any wise appertaining. This conveyance is intended as a mortgage, to secure the payment of the sum of dollars, in [here state terms of payment], according to the condition of a certain bond, dated this day, and executed by the said party of the first part to the said party of the second part; and these presents shall be void if such payment be made. But in case default shall be made in the payment of the principal or interest, as above provided, then the party of the second part, his executors, administrators, and assigns, are hereby empowered to sell the premises above described, with all and every of the appurtenances, or any part thereof, in the manner prescribed by law; and out of the money arising from such sale, to retain the said principal and interest, together with the costs and charges of making such sale; and the overplus, if any there be, shall be paid by the party making such sale, on demand, to the party of the first part, his heirs or assigns.

In witness whereof, the said party [or parties] of the first part has [or have] hereunto set his hand and seal [or their hands and seals], the day and year first above written.

[Signature and seal.]

Signed, sealed, and delivered in the presence of

[Signature of witness.]

SATISFACTION OF MORTGAGE.

STATE OF }
COUNTY OF } ss.

I, E. F., of county of State of do hereby certify, that a certain indenture of mortgage, bearing date the day of one thousand eight hundred and made and executed by A. B. (and wife) of county of State of to me to secure the payment of dollars and recorded in the office of county of in liber of mortgages, page on the day of in the year one thousand eight hundred and , o'clock in the is paid.

And I do hereby consent that the same be discharged of record.

Dated the day of 18 .

In presence of

E. F.

[Signature of witness.]

[The satisfaction piece should be acknowledged before the proper officer.]

Liens.—A lien is a hold or claim which one person has upon the property of another as a security for some debt or charge. A lien differs from a mortgage in that it attaches as an incident to the matter of the debt by act of the law, while a mortgage is made for the express purpose of the security. A lien is the right to retain the property of another on account of labor employed or money expended on that specific property.

Other liens are on property never in the possession of the holder, but which, like that in favor of material men, mechanics and maritime lenders, show a peculiar equity in favor of the creditor as regards the particular property.

A particular lien arises out of labor or money applied to a specific article in the possession of the creditor.

A general lien is a right to retain property in possession for a general balance.

Inn-keepers, warehousemen, tailors, common carriers, repairers, brokers, sellers, and pawnbrokers have particular liens for services rendered or for money advanced on the property in their possession.

Attorneys have a general lien on the papers of their client and also upon judgments obtained by them. Bankers have a general lien on all securities left with them for moneys advanced at any time after the receipt of the securities. These are the common law liens and are allowed in every State without any statute. When possession is given up the lien is lost.

Maritime liens are those of a shipper on the vessel for the value of the goods sent, of the owner of the ship on the goods for freight, of the master of a ship for wages and disbursements, of a seaman for wages, of a material man for supplies, etc., furnished; of injured parties in case of a collision, and of the part owners for extra advances.

Promissory Notes.—A promissory note is a written promise to pay a certain sum of money at a future time unconditionally.

The party signing the note is called the maker, and the party in whose favor it is drawn the payee.

If payment is to be made only to the payee, the note is not negotiable; but if made payable to him, his order, or to bearer, it has the necessary qualifications of negotiable paper.

A promissory note, after it has been endorsed by the payee, is similar to a bill of exchange, and is governed by most of the rules which apply to bills. The essential qualities to give validity to a note are that it be paid absolutely and at all events (that is, that its payment is not to depend on any condition), and in money.

A note passes by endorsement, which may be in full or in blank, as in the case of bills of exchange.

If endorsed in blank it can be transferred through any number of hands without further endorsement until presented for payment, when the holder of the note writes over the last endorsement an order to pay the note to him or his order. It is always advisable, however, to have the endorsement of each party through whose hands the note has passed.

Notes bear interest only when so stated therein.

After maturity, all notes bear interest.

Three days, called "days of grace," are allowed after the time mentioned in the note for payment.

If the last of these days falls on Sunday, the note must be paid on the previous Saturday.

If a note having no days of grace falls due on Sunday, it need not be paid until the following Monday.

The same rule holds good with reference to legal holidays, in which case the note must be paid on the day previous if it has days of grace, otherwise on the day immediately following.

Notes payable on demand are not entitled to "days of grace."

Notes obtained by fraudulent means are void.

It is usual, and sometimes necessary, especially in Pennsylvania and New Jersey, to use the words, "without defalcation or discount, for value received" in a note.

If an endorser does not wish to be held liable on a note he should write the words "without recourse" before his name. Written words in a note prevail over written figures at the top or bottom. A material alteration in a note discharges all the parties who have not consented to the alteration.

As between a maker and a payee of an accommodation note, the payee cannot enforce payment; but if he has endorsed the note, and it has passed into the hands of an innocent holder for value, the maker is liable.

If no place of payment is mentioned, demand for payment of a note must be made of the maker at his residence or usual place of business by the holder or his authorized agent on the day the note falls due, and if payment is not made, notice must be immediately given to the endorser in order to hold them liable.

If a note is not paid when it falls due, it is said to be dishonored.

If the parties reside in the same city or town, notice of dishonor must be served personally on them by leaving notice at their homes or places of business; but if the parties reside in different places, notices must be mailed to them not later than the next day after demand and refusal.

Each endorser is allowed a day in which to serve notice on his immediate preceding endorser. No precise form of notice is necessary.

Notices of dishonor and protest are usually sent by notaries public, for the reason that in most States the protest and certificate of such an officer are regarded as *prima facie* evidence of the facts stated therein.

Bank Checks.—A check is a written request addressed to a bank or a banker by a person having money on deposit with either, directing that a certain sum of money be paid by said bank or banker to a person named therein, or his order, or to the bearer.

A check on a bank should be presented for payment at once or within a reasonable time.

The drawer of the check is not discharged from liability by delay in the presentment, unless he can show that he has suffered injury by the delay, as, for example, by the failure of the bank on which the check was drawn.

If a bank pays a check which has been forged, it must bear the loss.

An acceptance of a check is not a discharge of the debt, unless the parties intended it to be such.

Checks are transferred by endorsement on the back, and this may be in full or in blank, as in cases of bills of exchange.

Payment and Tender.—Payment is the fulfillment of a promise, or the performance of an agreement, or the discharge in money of a sum due.

Payment must be in money or in something accepted in its stead, by some one authorized to receive it. The legal tender established by law is regarded as money. United States coins of all denominations and treasury notes are such.

Negotiable bills and notes of individuals may be taken in payment of a debt, but only have the effect of, and operate as, payment, when taken with that object in view; in Maine and Massachusetts they are presumed to be taken in payment if the contrary is not expressly shown. Giving one's own promissory note is no payment of a debt unless so understood by both parties. If a note or bill is taken on a debt, due diligence must be taken to collect it at maturity, or it will operate as payment by being treated as the bill of the receiver, and discharging the parties to it.

Giving a check is not payment until it is cashed, or an unreasonable time has been allowed to elapse after the receipt of the check, and the check has been lost thereby.

A receipt is *prima facie* evidence of payment. Other evidence, such as the possession of a note by the maker, etc., go to prove payment.

Payment to an agent or attorney is good if the agent is authorized to receive payment, and so also is payment to the wife, if she is authorized to

receive it. An agent, however, can not receive anything but money in payment, unless specially empowered to do so.

Sometimes it is necessary to make a formal tender, if payment will not be taken, or proof of the offer is desired.

Tender should be made to the party entitled to receive payment. The exact amount in strict legal tender money should be offered, stating the amount, and offering it unconditionally, except that in paying a note the note may be required to be given up as a condition of the tender.

A receipt can not, however, be insisted upon without vitiating the tender.

It is commonly supposed that a receipt can be demanded and insisted upon when money is paid. There is no law to compel a man to give a receipt when he receives money, and he can refuse to do so.

Tender, if good and sufficient, stops interest and accruing damages on the debt.

Guaranty.—A guaranty is an undertaking to answer for another's liability, and is collateral thereto, or, in other words, it is a contract by which one person is bound to another for the fulfilment of a promise or engagement of a third party. It differs from a warranty, which is given in reference to the title, quality, or quantity of a thing sold. No special words are necessary to constitute a guaranty. If the party clearly shows that it is his intention to guaranty, it is sufficient.

In order that the guarantor may be held, the guaranty should be in writing, signed by him. If the guarantor pays his principal's debt he is entitled to all the securities of the creditor.

The conditions of the guaranty must be strictly followed, otherwise the guarantor will not be held.

The guaranty must be founded on a consideration, otherwise it is of no force.

It is a sufficient consideration if the party for whom the guaranty is given derives a benefit, or the party to whom it is given suffers an injury, because of his acting on the faith of the guaranty. No consideration need pass from the party receiving the guaranty to the guarantor. The agreement of both parties is necessary to make a guaranty binding on the guarantor. The guarantor can be held only for the amount agreed upon, or for the time mentioned in the guaranty.

If the principal fails to pay the debt, the guarantor should be notified. A guaranty is always revocable until it has been acted upon.

GUARANTY OF PAYMENT OF NOTE.

For value received, I hereby guarantee the payment of the within note.
[Date.] [Signature.]

GUARANTY OF PAYMENT OF BOND.

In consideration of the sum of one dollar to me in hand paid by C. D., I hereby guarantee the payment of the foregoing bond.

Witness my hand [and seal], the day of 18 .
[Signature, with or without seal.]

Warranty.—Warranties which accompany a sale of personal property are of two kinds in respect to their forms, express and implied.

An express guaranty is one by which the warrantor covenants or undertakes to insure that the thing which is the subject of the contract is or is not as there mentioned, as, for example, a horse is sound.

An implied guaranty is one which, not being expressly made, the law

implies by the fact of the sale. For example, the seller is understood to warrant the title of the goods he sells when they are in his possession at the time of the sale. If they are not in his possession when sold and no affirmation of title is made, the buyer purchases at his risk.

As a general rule there is no implied warranty as to the quality of the goods sold.

If a buyer asks for or receives a warranty, it is his fault if it does not cover as much ground and give him the protection he intended it should.

It is always in the power of a purchaser to demand a warranty, and if he purchases without one he does so at his own risk.

No precise words are necessary to constitute a warranty. It is sufficient if the words used show an intention on the part of the owner that the article sold is in every respect as represented.

For the protection of the purchaser he should have the warranty reduced to writing and signed by the owner.

Receipts.—A receipt is a written acknowledgment of payment or delivery of money or property.

It is made by the party receiving the money or goods. A receipt is the party's admission of the delivery to him. It is simply presumptive evidence of the delivery and not conclusive at all on the party. The rule which applies to written agreements, that they can not be varied by parol evidence, does not apply to a receipt; but the party may show the circumstances under which it was given, and may avoid its effect not only by showing that he was led to give it by fraud, or by some serious mistake, but generally by any clear proof that the money receipted for was not actually paid.

Receipts "in full" of a specified debt, or "in full of all accounts," or "all demands," are much more conclusive, and though not then operating as a release, extinguishing the debt itself, still are evidence of a compromise and mutual settlement of the rights of the parties. Greater force is given to a receipt if a seal is affixed.

A receipt is evidence in any matter to which it is an incident. A receipt cannot be demanded as a condition of payment of a debt, nor can the party receiving payment be compelled to give a receipt. It is always the safer course to pay the debt in the presence of witnesses.

Releases.—A release, unlike a receipt, is the giving up or abandoning a claim or right to the person against whom the claim exists or the right is to be exercised or enforced, while a receipt is simply evidence which may show that a claim is extinguished, but does not, however, itself extinguish it.

A release cannot be varied by testimony or outside evidence.

In general, a release should express a consideration; and it is usual to state a nominal consideration if there is no other; and the instrument should also be under seal.

A release by one of several persons who must sue together, given to one of several persons who must have been joined as defendants if an action had been brought, is valid, and has the effect of discharging all the debtors, if it be under seal; but it is competent for the parties to prevent this effect by expressing in the release that it is not to discharge the other joint debtors.

Recovery of Debts.—Several of the States have abolished arrest and imprisonment for debt. In all the States, however, if it can be shown that

fraud was committed in the contraction of the debt, or that the debtor is about to abscond, arrest and imprisonment are still allowed.

Writ of attachment and the garnishee or trustee process are allowed quite universally throughout the States.

By the trustee or garnishee process, a person who has money or property in his possession belonging to a defendant, which money or property has been attached in his hands, and who has notice of such attachment, is bound to keep the property in his possession to answer the plaintiff's claim until the attachment is dissolved or he is otherwise discharged.

Deeds.—A deed is any written instrument containing a contract or agreement signed, sealed and delivered as the act of the person making it. It is a term used more commonly in reference to conveyances of lands, tenements and hereditaments.

The requisites of a deed are that it be printed or written on paper or parchment, and be made by a person capable of contracting and with a person capable of being contracted with, and contain the names of the grantor and grantee; there must be something to be contracted for; it must contain the requisite parts and be sealed and delivered, and should be signed and witnessed, and for the purpose of being recorded should be acknowledged in the manner required by statute in the State or Territory where the property is situated. The deed should be signed by the grantor and by his wife, if he has one, and be acknowledged by both unless there be a statute rendering this unnecessary. The consideration should be expressed in the body of the instrument, even though it be for the nominal sum of one dollar.

In those States where the wife has dower, the grantor, if married, cannot give a good title, unless his wife signs the deed with him. She cannot be compelled to sign. The grantee should refuse to accept a deed without her signature in those States where dower has not been abolished. The grantee should see that words showing that the wife releases her dower and right of dower are used in the deed.

It is advisable to have a deed witnessed by at least two disinterested persons. Although a seal may not always be required, it is more prudent to affix one at the end of each signature.

The grantor pays for drawing the deed; the grantee pays for searching the title.

For the greater security of the grantee he should have search made for the following incumbrances on the property: Transfers, mortgages, liens pendens, commissioner's loans, judgments in the county clerk's office and in the U. S. district and circuit courts, taxes and tax sales, sheriff's and marshal's sales, insolvent and general assignments, appointment of receivers and appointment of trustees of absconding, concealed, non-resident or imprisoned debtors; mechanics' and other liens, and exemptions under the homestead act.

The grantor is the party making the deed and the grantee the party in whose favor it is made and to whom it is delivered. The usual covenants in a deed are that the grantor is lawfully seized; that he has a good right to convey; that there are no incumbrances on the property; that the grantee shall have quiet enjoyment, and that the grantor will warrant and defend the title against all lawful claims. The grantor signs his name, or it is done by some person in his presence and by his direction, or by an agent authorized by an instrument under seal to do so. If a grantor

requests it or cannot read, the instrument must be read over to him before its execution. If the grantor is unable to write, he makes

his

“his mark,” as, for example, James X Brown.
mark

If a corporation transfers property, the president usually signs the deed as president and affixes the corporate seal.

All erasures or interlineations should be noted at the foot of the instrument, and just above the signatures of the witnesses.

All blanks in a deed should be filled before execution.

Any material alteration in a deed after execution makes it void.

There should be a delivery and acceptance of a deed to make it operative.

A deed poll is one which binds only the party making and executing it.

A deed is construed in a manner favorable to its validity, and is governed by the law of the place where the land is situated as to form and requirements.

It is the duty of the grantee to have the deed recorded immediately after it is delivered to him. If he should fail to do so, and the grantor should make another conveyance of the same property to a third party who was ignorant of the first sale, he would lose his title, provided said third party recorded his deed immediately. For example, if A sells land to B, who neglects to record his deed, and A afterward, and before B's deed is recorded, sells the same property to C, who is ignorant of the sale to B, B would lose his title to the property, provided C recorded his deed before B's was on record. The deed should be recorded in the office of the register or clerk of the county where the property is situated.

WARRANTY DEED.

This indenture made this day of in the year one thousand eight hundred and between A. B., of the city of and State of merchant [and C. B. his wife], of the first part, and E. F., of in said county, farmer, of the second part, Witnesseth: That the said party [or parties] of the first part, in consideration of the sum of dollars, lawful money of the United States, to him [or them] in hand paid by the said party of the second part, at or before the ensembling and delivery of these presents, the receipt whereof is hereby acknowledged, and the said party of the second part, his executors and administrators, forever released and discharged from the same, by these presents, has [or have] granted, bargained, sold, aliened, remised, released, conveyed and confirmed, and by these presents does [or do] grant, bargain, sell, alien, remise, release, convey and confirm unto the said party of the second part, and to his heirs and assigns forever, all [here insert description], together with all and singular the tenements, hereditaments and appurtenances thereunto belonging or in any wise appertaining; and the reversion and reversions, remainder and remainders, rents, issues and profits thereof; and also all the estate, right, title, interest [dower and right of dower], property, possession, claim and demand whatsoever, both in law and in equity, of the said party [or parties] of the first part, of, in, and to the above-granted premises and every part and parcel thereof, with the appurtenances. To have and to hold the above-mentioned and described premises, with the appurtenances and every part thereof, to the said party of the second part, his heirs and assigns, forever.

And the said A. B. and his heirs, the above-described and hereby granted and released premises, and every part and parcel thereof, with the appurtenances, unto the said party of the second part, his heirs and assigns, against the said party [or parties] of the first part, and his [or

their] heirs, and against all and every person and persons whomsoever, lawfully claiming or to claim the same or any part thereof, shall and will warrant and forever defend.

In witness whereof the said party [or parties] of the first part has [or have] hereunto set his hand and seal [or their hands and seals] the day and year first above written.

[Signatures and seals.]

Signed, sealed, and delivered in the presence of

[Signature of witness.]

QUIT-CLAIM DEED.

Know all men by these presents that I [or we], A. B., of county of State of [and C. B. his wife], in consideration of dollars to me [or us] paid by E. F. of the receipt of which is hereby acknowledged, have remised, released, and forever quit-claimed, and by these presents do for myself, my [or ourselves, our] heirs, executors and administrators, remise, release, and forever quit-claim unto the said E. F., his heirs and assigns, forever, all such right, title, interest [dower, right of dower], property, possession, claim, and demand as I [or as we, or either of us] have or to have in or to all [insert description of premises.]

To have and to hold said premises unto the said E. F., his heirs, and assigns, to his and their only proper use and behoof forever, so that neither I, the said A. B., or any other person in my name and behalf [or we, the said A. B. and C. D., or either of us, or any other person in our or either of our names and behalf], shall or will hereafter claim or demand any right or title to the premises or any part thereof, but they and every of them shall by these presents be excluded and forever barred.

In witness whereof, I [or we] have hereunto set my [or our] hand[s] and seal[s] this day of 18

[Signatures.] [Seals.]

Signed, sealed, and delivered in the presence of

[Signatures of witnesses.]

Acknowledgment and Proof of Deeds.—Acknowledgment is the act of a person who has executed a deed in going before a competent officer or court and admitting the genuineness of the instrument and that it was made voluntarily. This acknowledgment is certified to by the court or officer who takes it, according to the laws of the State in which the acknowledgment is taken.

The deed or instrument is proved when the subscribing witness or witnesses come before the proper officer and declare its genuineness, and the declaration is certified to by the officer.

The certificate of the officer can not be altered after it is made unless there is a re-acknowledgment.

The acknowledgment authorizes the deed to be read in evidence without other proof of its execution, and at the same time entitles it to be placed on record, and should be required by the purchaser for his own security.

The officer taking the acknowledgment should sign his name and official title.

It is always prudent to have a witness to a deed, even though it is acknowledged, although this necessity has been done away with by statutes in many of the States. If the deed is not acknowledged, always have two witnesses.

Delivery.—Delivery is the act of transfer of the written title to property (deeds), or of written promises to pay (notes). or of property itself according to contract. It is the final act which completes the contract and makes it irrevocable. When the deed is finally and intentionally handed to

the purchaser, his title to the land becomes as good as it formerly was when he was actually given a portion of a sod, or a twig, and put into possession before witnesses who were told of the intention of the parties, but a deed may be delivered in trust, conditionally, not to be complete till the happening of some specified event.

There is no particular form or method of delivery, which may be as various as the ways of giving any other paper, though an intention to deliver with all that it implies must exist, and the receiver must accept, with the intention of taking possession of the property conveyed, before the delivery is complete.

Delivery of a note is entirely similar, though it is oftener conditional, and more apt to be imperfect or fraudulent, the paper being less formal. But the imperfect delivery of a note, check, or draft may become binding on the maker if the paper gets into the hands of a holder in good faith who paid value for it, on account of the negotiable quality of the paper. Great care should be taken not to give up notes, etc., until the consideration of them is fully realized, or the contract under which they are given is thoroughly understood and complete. Notes should not be given in advance of a definite settlement or to evidence debts, for many persons have thus been held firmly to a promise they did not intend to make. A contract of sale, exchange, or gift is completed by the delivery of the personal property itself, which is simply giving it up into the possession or dominion of the proper party. It may be symbolical, as by the delivery of a key; the affixing of a mark, by measuring out or setting aside, but always with the intention to part with the property.

The contract of sale is not, however, always followed by delivery, as the article may by agreement remain with the seller. Such agreements are often given to defraud creditors, however, and should be closely watched.

Contracts.—A contract is an agreement between two or more parties to do or not to do some particular thing.

Contracts are made orally, in writing, or in writing under seal. There must be parties to a contract, a consideration, assent of the parties, and subject matter.

If any one of these essentials is wanting there is no contract. The thing to be done must be one not forbidden by law. If the assent of either party is obtained through fraud, fear, or compulsion, the contract is voidable, for the reason that the assent must be voluntary. There is always an implied consideration in a written contract under seal. There must be a meeting of the minds to make a valid contract. That is to say, the parties must understand the same thing in the same sense. The intention of the parties should be expressed clearly, and care should be taken to avoid the use of any doubtful word or words. The contract is governed by the law of the place where made, or the law of the place where it is to be performed. The parties to a contract must be capable of contracting.

Suits are constantly arising from the difficulty of learning the intention of the parties to the contract, because of the use of words whose meaning is doubtful or indefinite.

As a general rule, a contract can not be enforced against married women, a person under twenty-one years of age, an imbecile, an insane person, or against a person who was grossly intoxicated at the time the contract was made. It is advisable to have all contracts reduced to writing and signed. Each party should keep a copy of the contract.

The following agreements are void, unless there is some note or memorandum thereof in writing expressing the consideration, and signed by the person to be charged therewith, or his authorized agent:

Every special promise to answer for the debt, default, or miscarriage of another person.

Any agreement made upon the consideration of marriage, unless it is a mutual agreement to marry.

Any agreement which by its terms is not to be performed within a year from the time it was made.

Every contract for the sale of goods, wares, or merchandise for the price of fifty dollars or upward is void, unless the buyer shall accept and actually receive part of the goods sold, or pay some part of the purchase-money, or there be some memorandum of the contract in writing signed by the party to be charged by such contract, or his authorized agent.

All contracts in reference to land, except leases for a period not longer than one year, must be in writing. If the party to be charged can not write, his mark will be sufficient to bind him to the contract. Where the parties have reduced their intentions to writing, the written instrument is considered the best evidence of what was intended.

In case of important contracts it is usual to affix seals to the instrument, and have the execution acknowledged.

GENERAL FORM OF CONTRACT, WITH PROVISION FOR LIQUIDATED DAMAGES IN CASE OF BREACH.

This agreement, made the day of one thousand eight hundred and by and between A. B., of the town of county of State of of the first part, and C. D., of county of State of of the second part, Witnesseth: That the said party of the second part covenants and agrees to and with the party of the first part, to [here insert the subject-matter of the agreement]. And the said party of the first part covenants and agrees to pay unto the said party of the second part, for the same [here insert the consideration and the terms of payment].

And for the true and faithful performance of all and every of the covenants and agreements above mentioned, the parties to these presents bind themselves, each unto the other, in the penal sum of dollars, as liquidated damages, to be paid by the failing party.

In witness whereof, the parties to these presents have hereunto set their hands and seals, the day and year first above written.

[Signatures.] [Seals.]

Signed, sealed, and delivered in the presence of
[Signatures of witnesses.]

Consideration.—A contract or promise, for which there is no consideration, can not be enforced at law.

Considerations are good or valuable. A good consideration, is one of natural affection, love, or of blood. A valuable consideration is such as marriage, money, or something which can be converted into money.

A valuable consideration is the only one which is valid against a third party.

Mutual promises, to submit a matter in dispute to arbitration, are a valid consideration.

A promise not to take legal proceedings upon a valid claim is a valid consideration for a promise.

Trust and confidence are sufficient consideration. As for example, if A intrusts B with money or property to be delivered safely and in good order to C, the trust is a sufficient consideration for the promise of B to so

deliver, and B would be liable for loss or damage which occurred through his negligence, even though his promise were gratuitous.

A promise for a promise is a good consideration. For example, A promises to teach B a certain trade. This is a consideration for a promise on B's part to remain with A a certain length of time to learn the trade and serve him during that time.

As a general rule, the contract is void if any part of the consideration is illegal. If the consideration proves to be worthless, the contract is not binding.

Work and services rendered at the request of the promisor, are a sufficient consideration for a promise.

Assignments.—An assignment is the transferring and making over to another the entire interest which the person making the assignment has in the thing assigned.

The person making the assignment is called the *assignor*, the person to whom it is made the *assignee*.

Every demand connected with the right of real or personal property, such as estates, interests in lands, a term of years, rent to become due, debt for goods sold and delivered evidenced by book account, a judgment, a bond, balance of account, policy of insurance, promissory notes, checks, bills of exchange, etc., may be assigned.

The pay or commission of an army or navy officer can not be assigned, nor can the salaries of judges, nor a right of action for a tort or fraud.

The proper technical words in an assignment are, "assign, transfer, and set over," although any words which show the intent of the parties to make a complete transfer of their interests will answer.

An assignment will not hold good if not made in good faith, and any party in interest may object to it, and if he can show fraud on the part of the assignor it will be overturned.

The assignee of a debt should immediately after the assignment give notice of that fact to the debtor.

If the debtor has no notice of the assignment and pays the assignor, he is released from his indebtedness, but not so if notice has been given him.

The assignee takes the debt subject to all the claims which the debtor may have had against the assignor at the time of the assignment, or before the debtor had notice of said assignment, and has no better title than the assignor had.

Formerly an assignee was not allowed to sue in his own name, but by statutes in some of the States, especially in New York, Maryland, Ohio, Missouri, California, Arkansas, Mississippi, and Louisiana, the assignee of a debt may bring suit in his own name in a court of law.

The assignment should be in writing. This is not always necessary, but it is always better in order to be on the safe side.

A consideration for the assignment is only necessary for the purpose of sustaining it against creditors and third parties.

An assignment of a mortgage should always be acknowledged in order that it may be recorded, and it is advisable to have it sealed.

In order to make a valid assignment of an insurance policy the consent of the insurers should be previously obtained.

The rules governing assignment of an insurance policy, if an assignment is allowed, will be found incorporated in the body of the policy.

FORM OF ASSIGNMENT WHICH MAY BE ENDORSED ON THE INSTRUMENT ASSIGNED.

In consideration of the sum of dollars [or For valued received], I hereby assign the within [here give the name of the instrument assigned] unto John Smith.

[Date.]

[Signature.]

Bills of Sale.—A bill of sale is a written conveyance of personal property, by which one person transfers all his right and interest in the property to another.

It is advisable to have the conveyance under seal, although it is not always necessary.

If there is a delivery or part payment, no written instrument is needed; but it is always better to have one as evidence of title to the property.

If the seller continues in possession of the property after the sale, the sale is presumptively void as to subsequent purchasers and mortgagors who were ignorant of the transaction, unless the purchaser can show that there was no fraud in his purchase, and that he had good reasons for allowing the seller to retain possession of it.

*A COMMON FORM.

I, Joseph Gay, of the town of county of State of party of the first part, in consideration of the sum of dollars, lawful money of the United States, to me in hand paid by John Crump, of the town of county of State of do grant, bargain, sell, and convey to said John Crump [here name in detail articles or interest sold].

In witness whereof I have hereunto set my hand and seal this day of 18 .

[Signature.]

Signed, sealed, and delivered in the presence of
[Names of witnesses.]

Power of Attorney.—A power of attorney is a written instrument by which one person is empowered to act for another. A person acting under a power of attorney is called an attorney in fact. The power of attorney to authorize a person to execute a sealed instrument for his principal, should be under seal, executed, attested, and acknowledged the same as a deed. These powers are general and special, and empower the holders thereof to act the same as general or special agents, and are subject to the same laws of revocation as are the powers of agents.

A party dealing with an attorney in fact should examine his power, to see that he is authorized so to act.

All conditions in the power should be strictly followed out.

By the statutes of New York, if one of the attorneys in fact should die, the survivors can continue to act.

All the attorneys should join in executing their power.

In a conveyance of land the attorney should always use the name of his principal in the body of the instrument, and execute and acknowledge it in the name of his principal, with his own name as attorney. An attorney is not authorized to appoint a substitute, unless he is ~~special~~ empowered to do so by his power of attorney.

A SHORT FORM.

Know all men that I, John Smith, of the town of in the county or State of do hereby make, constitute, and appoint James Brown, of the town of county of State of my true and lawful attorney for

me and in my name to [here insert what the attorney is authorized to do] and to do and perform all acts or things in the execution of the aforesaid business, as fully and completely as I might do were I present.

In witness whereof, I have hereunto set my hand and seal this day
of 18 .

[Signed by person granting the power.]

Signed, sealed, and delivered in the presence of

[Signature of witnesses.]

Wills.—A will is the disposition of one's property to take effect after death.

Any one of sound mind and of the age of twenty-one years, or majority, may make a will of real property.

A will must be signed by the party in the presence of witnesses who see the party sign, and who must sign in his presence and in the presence of each other.

The party must request the witnesses to sign his will.

The number of witnesses required in most of the States is two, but three are required in the District of Columbia, Connecticut, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Mexico, and South Carolina.

A gift of real property is termed a devise; a gift of personal property a bequest or legacy.

All persons may take personal property by bequest, and all persons capable in law of holding real property may take real property by devise.

Corporations, however, cannot take real property by devise, unless they are specially authorized to do so by their charters or other laws. And by a recent act in New York, it is provided that, no person having a husband, wife, child, or parent, shall devise or bequeath to any benevolent, charitable, literary, scientific, religious, or missionary society, association, or corporation, in trust or otherwise, more than one-half part of his or her estate, after the payment of debts; and such devise or bequest shall be valid to the extent of one-half and no more.

No particular words are needed to constitute a will. With an exception in favor of soldiers and sailors, who from necessity the law allows to make wills verbally—called nuncupative wills—there must be a written statement of the testator's wish, signed by him. Any statement, however, which makes the testamentary character apparent, is sufficient to give the instrument the character of a will.

In no case does a will have any operation until a testator's death. And it may be made upon condition, so that even then it will not take effect except under the circumstances specified. Two persons can make a conjoint or mutual will.

It is very common to commence wills with a formal preamble, reciting the testator's capacity to make a will, and the feelings which move him to the act. These phrases are not, however, of any legal efficacy, and may be inserted or not at pleasure. It is advisable to affix a seal to a will, although it is not required in all of the States, to give validity to it.

Wills may be avoided by cancellation or revocation, or by the execution of a will of later date. Marriage, with the birth of issue, amounts to an implied revocation.

A bequest to a wife in lieu of her dower must be clearly expressed, or she will be entitled to both; provided that the claim of dower is not inconsistent with the provisions of the will. The courts, however, require clear

proof of the inconsistency. Such bequest, however, will not deprive her of her dower, but she has her choice between the two.

A codicil is a supplement or an addition made to a will by the testator, annexed to the same, and to be taken as a part of it; being intended for its explanation or alteration, or to make some addition to, or subtraction from, the former dispositions of the testator. It should be executed in the same manner and with the same formality as the original will.

A codicil, like a will, may (unless controlled by statute) be either written or nuncupative.

Wills should be drawn carefully so as to express plainly and exactly the wishes of the testator.

Soldiers and sailors in active service may make a declaration of their will by word of mouth to any witnesses who may be convenient. There should be three witnesses. The witnesses reduce the oral declaration to writing and attest it.

In general, a beneficial devise or bequest to a subscribing witness is void, unless there are the requisite number of other competent subscribing witnesses, so that the will may be proved without resort to the testimony of the interested witness.

It is usual and proper, but not essential, to write at the end of the will, below or at one side of the testator's signature, a statement of the place, time, purpose and circumstances of the signatures and execution, and to let the witnesses sign below. This statement is called the attestation clause. The advantages of such a statement is in facilitating the probate of the will. If a witness has no recollection of his attesting the will, but recognizes his name under such a statement as written by himself, and testifies that he should not have written it there had he not known the statement to be true, the courts will generally receive this as supplying his defect of memory.

The attestation must, except in a few States, be in the presence of the testator, but need not necessarily be in the same room, if he is so placed as to see the act. Against the name of every witness his residence or address should be written. In some of the States this is required by law, and in all cases it is convenient and always advisable; but the absence of this, even where it is required, does not invalidate the will.

WILL OF BOTH REAL AND PERSONAL ESTATE.

I, A. B., of _____, in the county of _____, and State of _____, merchant, being of sound and disposing mind and memory, do make, publish and declare this to be my last will and testament, hereby revoking all former wills by me at any time heretofore made.

And as to my worldly estate, and all the property, real, personal, or mixed, of which I shall die seized and possessed, or to which I shall be entitled at the time of my decease, I devise, bequeath and dispose thereof in the manner following, to wit:

My will is, that all my just debts and funeral expenses shall, by my executors hereinafter named, be paid out of my estate, as soon after my decease as shall by them be found convenient.

I give, devise and bequeath to my beloved wife, C. B., all my household furniture, my horse and chaise, and the chaise harness; and also \$____ in money, to be paid to her by my executors, hereinafter named, within _____ months after my decease; to have and to hold the same to her and her executors, administrators and assigns forever. I also give to her the use, improvement and income of my dwelling-house, land, and its appurtenances, situated in _____ aforesaid [describing the same], and my land

situated in [describing the same], to have and to hold the same to her for and during the term of her natural life.

I give and bequeath to my honored mother, E. B., dollars in money, to be paid to her by my executors hereinafter appointed, within months after my decease; to be for the sole use of herself, her executors, administrators and assigns.

I give and bequeath to my daughter, L. B., my shares of the stock of the President, Directors, and Company of the Bank in County of , and State of , which are of the par value of dollars; to have and to hold the same together with all the profits and income thereof, to her, the said L. B., her heirs, executors, administrators and assigns, to her and their use and benefit forever.

I give, devise and bequeath to my son, H. B., the reversion or remainder of my dwelling or mansion house and its appurtenances, situate in aforesaid [describing it], and all profits, income, and advantage that may result therefrom, from and after the decease of my beloved wife, C. B., to have and to hold the same to him, the said H. B., his heirs and assigns, from and after the decease of my said wife, to his and their use and behoof forever.

I give, devise and bequeath to my son, J. B., the reversion or remainder of my land situated in [describing it], and its appurtenances, and all the profits, income and advantage that may result therefrom, from and after the decease of my beloved wife, C. B., to have and to hold the same to the said J. B., his heirs and assigns, from and after the decease of my said wife, to his and their use and behoof forever.

All the rest and residue of my estate, real, personal and mixed, of which I shall die seized and possessed, or to which I shall be entitled at my decease, I give, devise and bequeath, to be equally divided between and among my said sons, H. B. and J. B.

And, lastly, I do nominate and appoint my said sons, H. B. and J. B., to be the executors of this my last will and testament.

In witness whereof, I, the said A. B., have to this my last will and testament, consisting of sheets of paper, subscribed my name and affixed my seal this day of , in the year of our Lord one thousand eight hundred and .

Signed, sealed, published, and declared by the said A. B., as and for his last will and testament, in the presence of us, who at his request and in his presence, and in the presence of each other, have subscribed our names as witnesses thereunto.

A. B. [Seal.]

	residing at	in	county.
[Signatures of witnesses.]	residing at	, in	county.
	residing at	, in	county.

Executors and Administrators.—An executor is a person whom the testator appoints by his will to carry out his wishes therein expressed.

As a general rule, all persons capable of making wills and many others can be executors.

Executors can be appointed by will or codicil; explicit words of appointment are not necessary, although usual.

An administrator is a person appointed by the proper court to take charge of and distribute the estate of an intestate or of a testator who has no executor. An administrator *with the will annexed* is a person appointed by the court to manage and distribute the estate of the testator when no executor is named in the will, or the person appointed in the will refuses ~~to act~~ or the executor dies before he has completed his duties as such ex-

ecutor. Both executors and administrators are regarded as the personal representatives of the deceased, having in their hands his means for the purpose of paying his debts, completing his contracts, and of carrying into effect his will if he has left one.

The proper persons to take out letters of administration are, as a general rule, the husband or wife; then the children, male preferred to female; then the father or mother; then the grandparents; and in many of the States a creditor can apply for letters of administration if the proper persons refuse or delay to apply. In general, anybody can be an administrator who can make a contract, but the above parties have the preference.

The authority of an executor dates from the moment of his testator's death; that of an administrator does not exist until letters have been granted to him, and then it reverts back to the time of the death of the deceased, and then only for the purpose of protecting the estate.

The executor is, as a general rule, required to give a bond before letters testamentary are issued to him, unless this requirement is done away with by statute, or the testator expressly directs in his will that no bond be required.

A bond is always required of an administrator.

The duties of executors and administrators being so similar, what follows will be applicable to both.

Immediately after letters testamentary or of administration are issued to a person he must prepare an inventory of the property and file it. He must pay the funeral expenses. Within a convenient time after the death of the deceased he should collect the goods if he can do so peacefully; if not, he should take legal measures; he must collect the goods and chattels and the claims inventoried; he should give notice of his appointment as required by statute, and should advertise for debts and credits; if he is an executor he must follow the directions of the will in reference to personal effects; but if an administrator, he must collect, appraise, and sell the whole; he must keep the money safely, and may be charged interest on it; he must pay the debts in the following order—first, funeral expenses, as referred to above; then United States, State, county, and town debts; then general creditors, after which the legacies are to be paid. If a sufficient amount to pay the debts of the deceased is not realized from the sale of personal property, an application is made to the court issuing the letters, for an order to be allowed to sell the real property. After payment of debts an account of proceeding must be filed in the court issuing the letters; this usually must be done within a year from time of entering on the duties. Neither an executor nor an administrator can act outside of the State in which he was appointed. If either, while in the performance of his duties, make a bill or note and signs it, adding, “as executor,” or “as administrator,” he is personally liable, unless he expressly limits his promise to pay by the words, “if the assets be sufficient,” or some equivalent words, but such a note or bill would not be negotiable because on condition.

Executors and administrators usually receive a commission for their services. If there are two or more executors and one of them die, the survivors or survivor continue to act. If all die, an administrator is appointed by the court on the application of the proper person.

The executor should notify all parties in interest that on a certain day he proposes to produce the will for probate and apply for letters.

Both executors and administrators should give notice to the parties in interest of their intention to file a final account and ask for a discharge.

After the expiration of a certain length of time, usually one year, any party in interest can apply to the court issuing the letters to compel the executor or administrator to account.

FORM OF A PETITION FOR LETTERS OF ADMINISTRATION.

[To be addressed to the Court of Ordinary, Court of Probate, Orphans' Court, County Court, or Surrogate (as the case may be), of the proper County.]

To the Court of Ordinary of in the State of :
 The petition of widow [or son or daughter, etc., as the case may be], of late of deceased, respectfully shows: That on or about the day of 18 , the said died, leaving goods, chattels, rights, credits, and real estate in aforesaid; that, to the best of the knowledge and belief of your petitioner, no last will and testament was left by the said deceased; that the deceased has left a widow your petitioner, aged years, and two children, aged years, and aged years; and that the deceased was, at and immediately preceding his death, an inhabitant of .

Your petitioner therefore prays that letters of administration may be granted on the estate of the said deceased, and that he [or she] may be appointed the administrator thereof.

[Signature.]

Dated this day of A. D. 18 .

FORM OF ADVERTISEMENT FOR GRANTING LETTERS OF ADMINISTRATION.

NOTICE.—Whereas letters of administration upon [or testamentary to, in case of an executor] the estate of late of have been granted to the subscriber, all persons indebted to the said estate are requested to make immediate payment, and those having claims or demands against the same, will make known the same without delay to

[Signature.]

Dated this day of 18 .

Administrator.

INVENTORY OF PROPERTY.

A true and perfect inventory and just appraisement of all and singular the goods and chattels, rights and credits, which were of late of county of and State of deceased, at the time of his death, to wit:

[Here append the inventory, estimating bonds, notes, book-accounts, and the like, under the headings of "good," "doubtful," and "bad." If real estate is to be appraised, include that in the same inventory, adding up, however, the inventory of the personal property separately.]

Taken and appraised by us, the day of 18 .

[Signatures.]

County, ss.

Personally appeared before me, Justice of the Peace [or any proper officer], in and for the said county and who upon their solemn oath [or affirmation], do depose and say, that they, at the request of [as the case requires], did well and truly, and without prejudice or partiality, value and appraise the goods, chattels, and credits which were of deceased, as set forth in the inventory hereto annexed, and in all respects performed their duties as appraisers, to the best of their skill and judgment.

[Signatures.]

Subscribed and sworn [or affirmed] to before me, this day of 18 .

[Name and title of officer.]

APPOINTMENT OF APPRAISERS.

Estate of deceased.—I, administrator of deceased, do hereby certify that I have selected and summoned [here insert names of persons summoned], disinterested and competent persons, to appraise the personal

property elected to be taken and kept by widow of under the [reciting section and Act under which claim is made].

Witness my hand this day of 18

[Signature.]

FORM FOR APPRAISEMENT.

The undersigned having been selected and summoned by administrator of deceased, to appraise the personal property retained by widow of deceased, under the provisions of [reciting as above], and having been respectively sworn [or affirmed], do value and appraise the same as follows, to wit: [inserting articles retained and value of each].

Witness our hands and seals this day of 18

[Signatures.] [Seal.]

[Seal.]

[Seal.]

Partition.—Partition is the division which is made between several persons, of lands, tenements, or hereditaments, or of goods and chattels which belong to them as co-heirs or co-proprietors. The division is either voluntary or compulsory.

Voluntary partition is made by the mutual consent of the owners, and is effected by mutual conveyances, without covenants of warranty, or by release to each person of the share which he is to hold, executed by the other owners.

Compulsory partition is made without regard to the wishes of one or more of the owners, and is effected by special laws provided for the purpose in each State.

Trusts and Trustees.—A trust is a right of property, real or personal, held by one party for the benefit of another. It is founded on confidence, and out of it grow two different estates, or property rights, the legal title of which is in the trustee, and the equitable or beneficial title in the person intended to be benefited by the property.

The objects for which trusts in lands may be expressly created are: 1. To sell lands for the benefit of creditors. 2. To sell, mortgage or lease lands for the benefit of legatees, or for the purpose of satisfying any charge thereon. 3. To receive the rents and profits of lands, and apply them to the use of some person named in the instrument creating the trust. 4. To receive the rents and profits of lands, and accumulate them.

Express trusts are created in express terms, in the deed, writing or will. They are usually found in sealed agreements, such as marriage articles, agreements for the purchase of lands, assignments for the payment of debts, and for carrying out bequests in wills to charities.

There are also implied trusts which are raised or implied by law from certain transactions, mostly being the expression of legal duty.

No particular form of words is necessary to the creation of a trust. Oral words may be sufficient to create a trust in personal property, but writing is necessary in the case of real property.

The person holding property for the benefit of another is called a trustee.

Executors, administrators, guardians, and assignees are trustees, to a certain extent, and the law of trusts is applicable to them.

A trustee is held to strict honesty in the disposition of the property. He can not retain any of the profits nor purchase the property upon its sale, nor can he speculate with the trust property.

A trustee is chargeable for the good and business-like management of the trust property.

The court will appoint new trustees on the death or disability of the original or any succeeding trustees.

A trustee may renounce or refuse to accept a trust, but having entered into it he can not rid himself of its duties unless he is legally discharged by the court, or the consent of all concerned. He can not delegate his powers to another, for the office is one of personal confidence.

Where there are several trustees they must act jointly by the majority, and can not act and bind the trust separately, though executors may.

Marriage.—Marriage is a contract made in due form of law, by which a man and woman reciprocally agree to live with each other during their joint lives, and to discharge toward each other the duties imposed by law on the relation of husband and wife.

The promises must be reciprocal; that is, there must be a promise on the part of each party.

It is not necessary that the promises to marry be made at the same time, provided that the offer is accepted before being recalled, or within a reasonable time after being made.

The contract to marry is completed by an acceptance of the offer.

After the contract is made, either party can bring an action for a breach of it on the part of the other party, unless the breach is committed by a party under legal age.

A marriage contract differs from other contracts, as it can not be rescinded at the will of the parties.

All persons are able to contract marriage, unless they are under the legal age or unless there are other disabilities.

At common law the age of consent is twelve for females and fourteen for males. If either party marries before arriving at the age of consent, the younger can, on arriving at that age, avoid the marriage.

If either party is an idiot, or insane, the marriage is void.

Force or fraud renders a marriage voidable; that is, it may be set aside, and a divorce must be granted on the application of the injured party only.

The parties must be willing to enter into the relation of husband and wife to make the marriage valid. If the willingness to marry is obtained through fraud, the marriage may be set aside. The force or fraud must be extreme and certain, otherwise the marriage will not be set aside.

Consanguinity and affinity within the rules prescribed by the laws of the various States and Territories render a marriage void.

Corporeal impotence renders a marriage voidable. This impotence must have existed at the time of the marriage, and must be incurable.

If either party has a husband or wife living, the marriage is void.

The parties must actually make a contract of marriage. The requirements and form will be governed by the laws of the State where the ceremony is performed.

The following are the proper persons to perform the ceremony of marriage:

Ministers of the gospel and priests of every denomination, mayors, recorders, and aldermen of cities, judges of county courts, and justices of the peace.

When the marriage is performed by a magistrate, no particular form is required, except the parties must solemnly declare in the presence of the

magistrate and a witness that they take each other as husband and wife. There should always be one witness to the ceremony.

The person performing the ceremony must, on application of either party, furnish a certificate signed by him, which must give the names and residences of the parties; the names and residences of the attesting witnesses; and the time and place of the marriage.

The statutes in some of the States require licenses to be taken out and notice of the intended marriage to be given.

In nearly all civil cases marriage may be proved by cohabitation, acknowledgment by the parties, reception by the family, and general reputation.

Dower.—Dower is the provision which the law makes for a widow out of the lands or tenements of her husband for her support and the nurture of her children. The word "dower" has reference to real estate exclusively.

In order to entitle the wife to dower there must have been a legal marriage which has not been dissolved, seizure of the husband, and his death.

In those States and Territories where dower is allowed, it is necessary that the wife join in a conveyance of the husband's real estate, in order to give the grantee a good title. In general, if there is no statement in the conveyance that the wife releases her "dower and right of dower," she can enforce it at the death of her husband.

The wife's dower or right of dower may be lost or barred by joining with her husband in a conveyance of land; by adultery on her part, and subsequent divorce, by foreclosure of a mortgage given by a husband before marriage, or by husband and wife after marriage; by a release of dower, and by a marriage settlement made previous to marriage in lieu of dower.

The wife must have been of age when she joined with her husband in a conveyance of land in order to bar her dower or right of dower. The widow has dower in that part of the estate which remains after all the encumbrances and liens against the same have been paid.

Dower is allowed in all the States and Territories except Arizona, California, Colorado, Dakota, Idaho, Kansas, Louisiana, Minnesota, Texas and Utah.

In Nevada, on the death of the husband, the wife takes the entire community property [that is, property owned by the husband and wife in common], after paying the debts, family allowances, and expenses of administration.

In New Mexico the wife has no dower except her private property, but she has one-half of all the other property remaining after paying the debts of the estate.

In Washington Territory the wife takes one-half of the common property, subject to the debts of both.

In Wyoming Territory the wife takes the entire estate, both real and personal, after paying the debts, provided that the estate does not exceed the sum of \$10,000.

Husband and Wife.—The husband is bound to provide his wife with all the necessaries of life as far as compatible with his means and their position in life.

If he furnishes a home for his wife, he cannot be held for her board if she does not occupy it. He can purchase and sell personal property with-

out her consent, and can purchase real property, but cannot sell it free from her claims without her consent, as she has a dower right in it. This right of dower has been abolished in some of the States, and where such is the case he can act as freely with his real as with his personal property.

As a general rule, the wife's personal property belongs to the husband, unless there is some statute to the contrary; and at common law, if a child is born alive before the death of the wife, he has a life estate in her real property.

The rights of the husband over the wife's property depend largely on the statutes of the different States.

The wife can call on the husband to furnish her with the necessary food and clothing according to his means and their position in life, and if he neglects or refuses to furnish them, she can get them on his account, and he will be bound to pay for them. She is entitled to dower in all the real property of which he died seized. Under the common law, by marriage the wife loses the title to her personal property and the use of her real property.

Parent and Child.—The parent is under legal duty to support the minor child. It is now held by high authority that a minor child who is not supported by its parent may purchase necessities on credit, and the tradesman may then sue the parent, on the theory of an implied contract, but if the parent supplies reasonable necessities the tradesman cannot hold the parent liable. If the child is in better circumstances than the parent, the father will not, as a general rule, be obliged to support it.

No man is bound to support the children of his wife by a former husband, nor can he compel them to pay him for their support if he provides for them.

The child cannot compel its parent to educate it. The child has a claim on its parent's estate for bare maintenance only.

The parent is not liable for the wrongful acts of the child. The father has the right to the custody of the child against all persons except the mother, and between him and her the court will decide.

The father has a right to the services of the child; consequently, if it be employed by another person, the father can collect its wages. The parent may give the child its time, in which case the child would be entitled to its wages.

The parent can bring suit for personal injury to the child.

The child is obliged to support its indigent parent if it is able to do so, but cannot be compelled to pay bills which the parent may contract. This obligation to support an indigent parent is enforced by the Superintendent of the Poor.

Divorce.—Divorce is the dissolution or partial suspension by law of the marriage relation. Marriage is often called a contract, but it is one that establishes a relation or status and cannot be broken or dissolved by mutual consent, nor is the wrong-doing of either party sufficient to authorize a dissolution or break the contract until a solemn judgment of the court or act of legislature formally dissolve the relation. So that usually, if there is no defence to a suit for divorce, the case does not go by default, but is heard, so far as to show its justice or otherwise, and the desire of both parties for the same result, going so far as to produce connivance between them, is ground for denying the divorce. If the offence has been

forgiven or condoned, none is granted. So, if the cause is adultery and both are guilty of the same offence.

A degree of the nullity of a marriage is commonly called a divorce. It is granted when one of the parties is shown to have been married to a living party and not divorced, or the marriage was only pretended, forced or fraudulent, or between parties within the prohibited relationship, but these are also general causes of divorce.

A legal separation which was formerly granted more frequently than at the present time, and which left the parties married with none of the rights of marriage, is called a divorce from bed and board. It grows less common as the laws of divorce grow more liberal. It was granted for causes that are now grounds for a full divorce.

The canonical or scriptural ground of divorce is for adultery only; though impotency is also a general ground for divorce. Adultery and impotency are, as a general rule, grounds for a divorce in all the States and Territories.

Minors.—A minor, usually called an infant, is any person who has not yet attained the age of twenty-one years.

A minor can not enter into a binding contract, except for necessities.

The contracts of a minor are not void, but voidable.

A void contract is one binding on neither party, while a voidable contract is binding on the adult, but not on the minor, who may, during his minority, or within a reasonable time after he becomes of age, avoid the contract, if he so desires. A minor may make a binding contract for necessities for both himself and for his wife and children.

The word "necessaries" includes food, clothing, shelter, medical attendance, and other provisions for health and education.

The "necessaries" for a minor depend largely upon his social position. In some cases watches and jewelry are regarded as necessities. Although the law requires the minor to pay the value of the necessities of life, it does not bind him necessarily to pay the price set by the tradesman. The jury are to determine the value and the price where the bill is disputed.

If a minor gives his note for necessities, although he is held on the note he can be compelled to pay only the value of the necessities. If a minor enlists in the army or navy he can not avoid the enlistment.

He is liable for his frauds and torts.

If a minor fraudulently represents that he is above the age of twenty-one years, and by means of these representations obtains credit for goods not necessities, an action for fraud may at once be maintained.

If the articles are sold to a minor without fraudulent representations, and are in his possession when he rescinds the sale, the seller may retake them.

If a minor makes a voidable contract and advances money on it, and afterward avoids it, he can not recover back the money so advanced.

A minor can not disaffirm his contracts in relation to real property until he becomes of age. To confirm a contract touching real estate some positive act is required. A minor or his personal representatives are the only ones who can take advantage of his minority.

As a general rule, no male under the age of eighteen years nor female under the age of sixteen years can make a will of personal property. Both must be above the age of twenty-one years to will real property.

The responsibility of a minor under the age of fourteen years rests on evidence of knowledge of the nature of the act committed.

Servants.—A servant is a person who lets, hires, or engages his or her services to another to be employed at some particular occupation or at any occupation for the benefit of the employer, for a certain sum.

The servant must render services for the entire time of the contract, and on this depends his right to recover wages. Thus, if A should agree to work for B for one year and should leave without cause before that period had expired, he could not recover on his contract.

The master must employ the servant for the entire time of the contract, and should he discharge him without cause he would be liable to a suit for damages. It would be the duty of a servant in a case of this nature to endeavor to secure employment and thus reduce the amount of the damages. If he should fail to secure employment, his damages would be the amount of wages he would have received had he not been discharged.

If before the expiration of the term the servant leaves without cause he forfeits his wages.

The master may dismiss the servant before the expiration of his time for willful disobedience, immoral conduct, habitual neglect, and the servant will not be entitled to recover his wages.

The master must furnish the servant with suitable tools and implements of labor, and will be liable for injury which may result to the servant from any defectiveness in such tools which was known to him. If the servant's negligence contributed to the injury he can not recover.

If the tools and implements are not defective the master will not in general be responsible, as the servant is supposed to take into consideration the risks when he agrees for certain wages to accept the position. The master must use reasonable care in selecting competent and trusty servants.

Where proper care has been exercised in the selection of servants, the master is not responsible for an injury caused to one servant by the carelessness of another while both are engaged in the same service.

The master is bound by all contracts made by the servant within the scope of his authority. He is not bound to provide medicines and attendance in case the servant is sick.

The master is responsible for what his servant does during his regular employment. This is especially true in the fulfillment of contracts.

He is liable for injuries occasioned by the neglect or unskillfulness or the injurious acts of the servant during his regular employment.

In order to hold the master the act must be negligent and done during the servant's employment.

Real Property.—Real property is something which may be held by tenure, or which will pass to the heir of the possessor at his death.

It includes lands, tenements, and hereditaments, or, in other words, it includes the land and ordinarily whatever is erected, or growing, upon the same, as well as whatever is contained within it, or beneath its surface, as minerals, etc. Whatever is erected on the land by the owner is real property, and passes with the land. Growing crops planted by the owner of the soil are real property, but, if sold by him when fit for harvest, they become personal property. Manure made upon the farm in the usual manner, by consumption of its products, would be real property; so also whatever is fitted for, and actually applied to, real estate, if of permanent nature.

Personal Property.—Personal property is the right or interest which a man has in things personal. It consists in general of everything which a man can move around with him, such as household furniture, checks, notes, bonds, mortgages, books, copyrights, patents, stock of goods in a store; cattle, tools, farming utensils, hay, fodder, and whatever erections he may put on land which have not become fixtures.

The personal property of a person who dies without a will goes to the next of kin, and is divided up among them according to the statute of distributions in the several States.

Whatever is erected on the lands of another by permission of the owner is personal property; so also whatever a tenant erects for trade, domestic or manufacturing purposes, provided it can be removed without too great damage and is removed within a reasonable time.

Growing crops sold by the owner when fit for harvesting are personal property; so also are crops planted by a tenant, if fit for harvesting, or if his term of tenancy is uncertain.

Trees sold to be cut, without any right to have them stand to occupy the land and trees growing in a nursery, are personal property.

Landlord and Tenant.—The term "Landlord and Tenant" is used to denote the relation which exists by reason of a contract, expressed or implied, between two or more persons for the possession or occupation of lands, houses, or tenements, either for a certain fixed time, for life or at will.

The instrument for creating and defining this relation is called a lease.

It is not necessary that the contract for hiring real estate be reduced to writing if it does not exceed one year.

The relation of landlord and tenant is implied whenever there is an ownership of land in one, and an occupation of it by permission by another.

The existence of this relation may be inferred by receiving rent from the occupant.

If there is a lease, the rights and obligations of the parties are regarded as commencing from the date of the lease if no other time has been agreed upon, or from the delivery of the papers. If the lease be oral, it will go into effect from the day the tenant enters and takes possession. The right of possession remains in the landlord until the tenant enters, when the right passes over to him, and remains in him during his tenancy.

The landlord can bring an action for any permanent injury to his property, such as destroying fences, cutting timber, or breaking doors and windows. He can go on the premises for the purpose of making repairs and demanding rent, but must use no force to effect an entrance.

The landlord is not liable for any injury which may result to a stranger or to his property from neglect to repair, unless he expressly agreed to keep the premises in repair.

If the landlord agrees to repair, and fails to do so, the tenant cannot quit and discharge himself from payment of rent unless it is agreed between the parties that a failure to repair on the part of the landlord is to have such effect. The agreement to pay rent and the agreement to repair are independent of each other. The landlord can not violate the rights of his tenant by a sale of the property.

The tenant is entitled to quiet possession of the premises, and it is the duty of the landlord to see that he is not disturbed by one having a better title. The landlord must not disturb the tenant. Unless it is otherwise

agreed upon, the landlord must pay the taxes and assessments on the premises.

The landlord is under no obligation to repair unless he expressly agrees to do so, nor can the tenant make the repairs at the expense of the landlord.

After the tenant has entered, the right of possession passes to him and he can bring an action against any person who trespasses on his premises, or disturbs him in his possession of them. He is obliged to repair fences and public roads, and is liable for injury which may result from their ruinous condition.

The tenant must so manage his property that others are not injured by it.

He must do the property no substantial injury, and is bound to make general repairs without an agreement, and must keep the premises in tenantable condition. He must keep the buildings wind and water tight, keep the fences in repair, and replace doors and windows broken during his occupation. He is not answerable for ordinary wear and tear, nor is he compelled to put a new roof on a building.

The tenant of a farm is bound without express covenant to manage and cultivate it in a good and husbandlike manner, and to repair the fences and to keep the dwelling-house in repair. The outbuildings and erections on the farm must be repaired and kept up by the landlord or the tenant, according to the custom of the country where the farm is situated.

The tenant must preserve the timber and ornamental trees.

His chief duty is to pay rent, and it is no answer to a demand for rent that the premises are not in a fit and proper state for the purposes for which they were hired. In the absence of a particular agreement between the parties, the tenant pays for the time he has had possession of the premises. If he is deprived of possession by a person having a title superior to that of his landlord, or if his occupation of the premises is rendered so uncomfortable by acts on the part of the landlord as to justify his removal, he cannot be forced to pay rent.

If the tenant substitutes another tenant in his stead without the consent of the landlord, he is still liable for the payment of rent.

A tenancy for life terminates at the death of the life tenant.

If a person enters into possession with the consent of the landlord, but without any express bargain, he becomes a tenant at will.

A tenancy at will may be determined by the will of either party.

Either party is entitled to reasonable notice before the tenancy can be terminated.

It is a general rule that in the absence of statutes notice must cover the whole of one of the regular intervals between payments.

A notice of but one month is sufficient in New York.

A tenancy from year to year can only be terminated by a similar notice and for a like time.

Where the lease is for a definite period, no notice is necessary. No particular form of notice is necessary.

In a notice to quit there must be a reasonable certainty in the description of the premises of the parties and in the statement of the time when the tenant must quit. A tenancy may be terminated by a purchase of the property by the tenant, and also by a surrender of the lease by the tenant and an *acceptance* of it by the landlord.

After the tenancy has ended, the landlord may re-enter upon the premises if he can do so without violence.

If the tenant holds over, the landlord should call in the law to assist him in getting possession.

The tenant must yield up quiet possession.

If a tenant's estate is terminated by an uncertain event, as, for instance, if he is a tenant at will or from year to year, he is entitled to the crops growing at the time of the termination of the tenancy.

Whatever the tenant erects on the premises with the consent of the landlord, he can take away with him. Whatever he erects with the consent of the landlord for the purpose of improving the premises, he can remove at the expiration of his tenancy. In general it may be said that whatever he has erected during his occupation for his comfort, profit, or convenience, he may remove, if he can do so without injuring the premises, unless he has so connected it with the premises as to become a part thereof.

Leases.—A lease is a contract for the possession and profits of lands and tenements, either for life or for a certain fixed time, or during the pleasure of the parties.

Leases must be drawn and signed in duplicate, each party retaining a copy.

The party making the lease is called the lessor; he to whom it is made the lessee.

A lease must be for a shorter period than the duration of the lessor's interest in the land.

The formal parts of a lease by deed are the date, the names of the parties, the consideration, the description of the premises, and, lastly, express covenants, if any, are to be inserted.

Leases generally have a forfeiture clause in case the tenant refuses to pay rent or breaks any of the covenants. The forfeiture clause permits the landlord to re-enter and eject the tenant.

If the lease is for a period exceeding one year it should be in writing, and the parties should, as a general rule, have it recorded.

Leases of agricultural lands for more than twelve years are prohibited in the State of New York.

If it is intended that the lessee shall insure the premises, there should be a covenant to that effect on his part, which should state in whose name the insurance is to be effected, and for what amount. Obligations to repair depend on the terms of the lease. The lessee must keep the premises in as good a state of repair as when he took possession, subject, however, to the ordinary wear and tear. He is not obliged to improve a dilapidated building.

The lessee is not obliged to rebuild a building which has been accidentally destroyed by fire.

If a lessee enters into a general covenant to repair without making any exceptions, he is bound to restore any building which may be destroyed by tempest, lightning, fire, or other accident.

Leases usually contain a covenant by the lessee not to assign or underlet without the consent of the lessor.

A lease may be terminated at any time before the expiration of the term, if the premises are taken for public uses, or are wholly destroyed, or are used for purposes of ill-fame. The same result would follow should the tenant purchase the property.

LEASE WITH RIGHT TO RE-ENTER IN CASE DEFAULT SHALL BE MADE IN ANY OF THE COVENANTS OR IN PAYMENT OF RENT.

This indenture, made the day of one thousand eight hundred and between A. B., of county of State of party of the first part, and C. D., of county of State of party of the second part, Witnesseth: That the said party of the first part has letten, and by these presents does grant, demise, and to farm let, unto the said party of the second part [here insert a description of the property], with the appurtenances, for the term of from the day of one thousand eight hundred and at the yearly rent or sum of dollars, to be paid in equal [weekly, monthly or quarterly] payments.

And it is agreed that if any rent shall be due and unpaid for days after the same is due, or if default shall be made in any of the covenants herein contained, then it shall be lawful for the said party of the first part to re-enter the said premises, and to remove all persons therefrom. And the said party of the second part does covenant to pay to the said party of the first part, the said yearly rent as herein specified. And at the expiration of the said term, the said party of the second part will quit and surrender the premises hereby demised, in as good state and condition as reasonable use and wear thereof will permit, damages by the elements excepted. And the said party of the first part does covenant that the said party of the second part, on paying the said yearly rent, and performing the covenants aforesaid, shall and may peaceably and quietly have, hold and enjoy the said demised premises, for the term aforesaid.

In witness whereof, we have hereunto set our hands and seals this day of in the year of our Lord, one thousand eight hundred and .

A. B. [Seal.]
C. D. [Seal.]

Signed, sealed, and delivered in the presence of
[Signatures of witnesses.]

Partnership.—A partnership exists when two or more persons combine their property, labor and skill, or one or more of them, in the transaction of business for their common profit.

The partnership may be special or confined by the articles of agreement to a single transaction, or one or more particular lines of business.

The partnership is general when it is confined to no stated line of business. In the absence of stipulations as to the kind of partnership, and when there is no evidence from the course of trade, a partnership is presumed to be general.

The partners may own all the property of the firm together, or one partner may put in all the capital and the other furnish the skill or time in managing the business. Any one is a partner who participates in the profits and losses of the firm by agreement.

The partners are individually liable for the debts of the firm after the partnership funds have been exhausted.

A person may in most of the States become a special partner and limit his liability to the possible loss of the amount of capital contributed by him. In case of such a limited partnership, the partner must conform to the requirements of the statutes or he will be held as a general partner.

There must be general partners, and the names of the special partners must not appear in the firm name. They have all the duties and powers of active partners.

The rule of personal liability being general, such other arrangement must be in writing, acknowledged before some magistrate and recorded and advertised so that it will be actually or constructively known to all dealing with the firm.

A partnership may hold real estate for the purposes of the business or for the common profit, and in as far as it is partnership property, it is treated as personal property and is chargeable with the debts of the firm. Land purchased with the funds of the firm is liable for its debts.

Joint ownership of property, however, does not necessarily make a partnership. It must be dealt with as a basis or means of making money to indicate a partnership.

Giving employees a share in the profits of the business as compensation for services does not make such employees partners, and hence liable for the firm's debts. Partners own the profits as they arise, not after the performance of stated services.

No writing nor express agreement is necessary to constitute a partnership. When men join property and efforts in any enterprise for profit, the law lays down a code of rules. It recognizes a partnership no matter what the name used, even if the name of one only of the partners appears. All of the parties share the profits and losses equally, unless otherwise stipulated. Each can represent all, and can bind the company in any partnership business or in any transaction which seems to be within the scope of the partnership business.

Any one of the partners may terminate the partnership at any time, unless it is for a stated period of time. The death or insolvency of any one of the partners in itself produces the same result. When a company is wound up and any of the partners are dissatisfied with their allotted share of the assets, they may apply to the court for a receiver, who shall convert the firm property into money, and under the direction of the court divide the proceeds according to the contribution of each partner to the capital of the firm. It is advisable to have the partnership agreement in writing, although a partnership may be formed without a written agreement.

In any case partners have a very broad power of acting for each other. Either may deal with the common property as if he were the owner. He can bind the firm by notes signed in the firm name, and can contract debts in its name.

All the partners must join in executing a sealed instrument in the name of the firm, and in making a general assignment for the benefit of creditors, with preferences.

Dissolution may be provided for by the articles of partnership, or may take place by the insanity, death, or other absolute incapacity of one of the partners, or by his assignment of his interest to a stranger.

After the dissolution and a notice of the same to the public at large through the papers, and special notices to all customers and correspondents, no partner can increase or continue the liabilities of the other members, nor is he bound for any further debts of the firm.

Joint stock companies are partnerships whose capital is divided up into shares which are assignable, but in this country corporations are so generally resorted to that these are rarely formed.

Highways.—A highway is every passage, road, bridge or street, which a citizen has a right to use.

Highways are created by a legislative act, by necessity, and by dedication. When private property is taken by a legislative act for a highway, a just compensation is given, which amount is usually determined by a jury, or by commissioners.

If a highway becomes impassable from any cause, the public have

a right to go on the adjoining land, even though there is a crop on the same.

The owner of land may dedicate it to the public for a highway by allowing it to be used as such without exercising control over it. The dedication may be evidenced by deed or by act of the owner, or his silent acquiescence in its use for twenty years. There may be a gift of the land on the part of the owner and acceptance on the part of the public.

By taking or accepting land for a highway, the public acquires only the right of way, and the incidents necessary to enjoying and maintaining it, subject to the regulation of the towns. All trees within the highway, except only such as are requisite to make or repair the road or bridges, on the same land, all grass thereon, and the minerals below, are for the use of the owner or occupant of the land.

The owners of the land on the opposite sides own to the center of the highways. If at any time the highway is abandoned the owner recovers the land.

The liability to repair is determined by statute, and, as a general rule, devolves upon the towns.

The commissioners of highways in the several towns have the care and superintendence of the highways and bridges within their respective towns. It is their duty to repair the bridges and roads and to regulate and alter such of them as a majority of the commissioners shall deem inconvenient; to divide their respective towns into so many road districts as they shall deem convenient; to assign to each of the said road districts such of the inhabitants liable to work on highways as they shall think proper, having regard to the proximity of residence as much as may be.

It is their duty to require the overseers of highways from time to time, and as often as they shall deem necessary, to warn all persons assessed to work on the highways to come and work thereon; to lay out on actual survey such new roads in their respective towns as they may deem necessary and proper, and to discontinue such old roads as shall appear to them on the oath of twelve freeholders of the same town to have become unnecessary; to cause mile-boards or stones to be erected on such public roads as they may deem proper to repair and keep in order.

It is the duty of overseers of highways in each town to repair and keep in order the highways in the several districts for which they were elected; to warn all persons assessed to work on the highways in their respective districts; to cause all noxious weeds within the highway to be cut down or destroyed, twice in each year; to collect all fines and commutation money; to cause all loose stones lying on the beaten track of every road to be removed; to keep up and renew the mile-stones and guide-posts; when necessary, to make another assessment on the residents in the town to keep the roads in repair.

Every person owning or occupying land in the town in which he or she resides, and every male inhabitant over twenty-one years, residing in the town where the assessment is made, shall be assessed to work on the roads in such town, and all moneyed or stock corporations, and the land of non-residents within any town, are subject to assessment for highway labor. Ministers of the gospel, paupers, idiots, and lunatics are exempt from highway labor.

Any person liable to highway labor may commute for the same in whole or in part, at the rate of one dollar per day, to be paid to the overseer within twenty-four hours after receiving the notice to appear and work.

It is the duty of the overseer to give twenty-four hours' notice to persons assessed to highway labor.

Every person refusing or neglecting to appear and work when notified by the highway overseer is subject to a fine for each day, and every hour such person or his substitute may be delinquent. If any such person or substitute shall remain idle, or not work faithfully or hinder others from work, such offender shall for every offence forfeit the sum of one dollar.

Overseers shall have power to require a cart, wagon, or plow, with a pair of horses or oxen, and a person to manage them, from any person having the same within his district; if he furnish them, according to order, he will be entitled to a credit of three days for each day's service therewith. If he neglect or refuse to furnish them, he is liable to a fine of three dollars per day for each day that he may be assessed.

No private road can be laid out over the lands of any person without his consent or the decision of a jury.

When a commissioner of highways has determined to lay out a new highway, or to alter or discontinue an old road, he must file such determination in writing at the office of the town clerk.

Any person aggrieved by any determination of the commissioner of highways, either in laying out, altering, or discontinuing any road, or in refusing to lay out, alter, or discontinue any road, may, at any time within sixty days after the commissioner's determination shall have been filed, appeal to the judge of the county, who shall appoint three disinterested freeholders, residents of the county, but not of the town, to hear and determine the appeal.

Trespass.—A trespass is any wrong-doing, or act of one person whereby another is injuriously treated or made to sustain damages.

Its more primary signification is any unlawful act committed with violence to the person, property, or rights of another.

Another restricted sense is any unauthorized entry on the real estate of another.

An act may be trespass though no damage be done, though damage is necessary to make a cause of action against the trespasser on the land of another person; the breaking of a blade of grass is said to be enough to constitute a trespass.

An action for trespass may be brought for personal injury, such as assault, battery, wounding, imprisonment and the like, for injuries to the person of another, directly injuring the complainant in his rights as a master, parent, etc., for injuries to personal property in taking it away; striking or chasing, if alive, and carrying away personal property, to the damage of the plaintiff.

Trespass on real property is consequent on entering, without right, on another's inclosure, though there may be none but an imaginary fence.

Easement.—Easement is a right which the owner of one parcel of land has by reason of his ownership to use the land of another for a special purpose not inconsistent with a general property in the owner, or, in other words, it is the privilege without a profit which the owner of one piece of land has in the land of another.

The land to which the right attaches is called the dominant estate, while that in or over which the right is to be exercised is called the servient estate.

The following are a few of the many easements:

The right of way which the owner of one piece of land has over the land of another; the right of receiving and discharging water over the land of another; the right of having support to buildings from the land of another; the right of the owner of one piece of land to have the natural flow of water pass from his land over the land of another; the right to go on the land of another and clear a mill stream or repair its banks; also the right to light and air.

The right of the public to use a highway is an easement.

An easement frequently arises from a continued use for a long period of time. The use in this case must be adverse, continued, and uninterrupted for the requisite period of time (usually twenty years), as, for example, the continued and uninterrupted use by the public of a road for twenty years.

Easements are divided into two classes—affirmative and negative.

Affirmative easements are those where the servient estate must permit something to be done thereon, as, for example, to pass over it or to discharge water upon it.

Negative easements are those where the owner of the servient estate is prohibited from doing something otherwise lawful on his estate because it will affect the dominant estate, as for example, excavating his land and thereby removing the support of a building standing on the dominant estate.

All easements must originate in an express grant, an implied grant, or, in prescription.

These easements may be extinguished by abandonment, release, and by merger, as, for instance, where the owner of the one estate acquires the title to the other.

Libel and Slander.—Libel and slander are injuries to one's reputation. Libel is that which is written or printed, which reflects on the character of another and is published without lawful justification or excuse, whatever the intention may have been; or in other words, it is inflammatory matter addressed to the eye.

Pictures, effigies and other visible signs may be libelous.

Slander differs from libel in that it is addressed to the ear. Criminal libel is a malicious defamatory matter made known to a third person by writing, by pictures, or by signs which are calculated to injure the living, to blacken the memory of the dead, and to hold them up to hatred, contempt and ridicule.

Civil libel is a malicious defamatory matter made known to a third person by writing, by pictures, or by false signs, which are intended to injure the living, or any publication which has a tendency to disturb the public peace or the good order of society.

It is a slander to charge a person with being guilty of a crime, or with having some contagious disease which renders him unfit for society; or to make a charge which affects a person in his trade, profession or business.

In these three cases it is not necessary to prove that the person slandered has suffered special damages. In all other cases of slander by speaking defamatory words, special damages must be proved.

The slander is supposed to be false until the contrary is shown.

The slander must be published, which is done when communicated to a third person.

A repetition of a slander already in circulation, renders the person repeating it liable to an action.

Malice, which is essential to support an action for slander, is always presumed until the contrary is proved.

STATISTICAL AND MISCELLANEOUS.

Population of American Cities.—The following table gives the population of the principal cities of the United States according to the census of 1880:

New York, N. Y.....	1,206,500	Minneapolis, Minn.....	46,887
Philadelphia, Pa.....	846,984	Reading, Pa.....	43,280
Brooklyn, N. Y.....	566,680	Hartford, Conn.....	42,553
Chicago, Ill.....	503,304	Wilmington, Del.....	42,499
Boston, Mass.....	362,535	St. Paul, Minn.....	41,498
St. Louis, Mo.....	350,522	Lawrence, Mass.....	39,178
Baltimore, Md.....	332,190	Dayton, O.....	38,677
Cincinnati, O.....	255,708	Lynn, Mass.....	38,284
San Francisco, Cal.....	233,956	Denver, Col.....	35,630
New Orleans, La.....	216,140	Oakland, Cal.....	34,556
Cleveland, O.....	160,142	Utica, N. Y.....	33,913
Pittsburgh, Pa.....	156,381	Springfield, Mass.....	33,840
Buffalo, N. Y.....	155,137	Portland, Me.....	33,810
Washington, D. C.....	147,307	Memphis, Tenn.....	33,593
Newark, N. J.....	136,400	Manchester, N. H.....	32,630
Louisville, Ky.....	123,645	St. Joseph, Mo.....	32,484
Jersey City, N. J.....	120,728	Grand Rapids, Mich.....	32,015
Detroit, Mich.....	116,342	Wheeling, W. Va.....	31,266
Milwaukee, Wis.....	115,578	Harrisburgh, Pa.....	30,762
Providence, R. I.....	104,850	Savannah, Ga.....	30,681
Albany, N. Y.....	90,903	Omaha, Neb.....	30,518
Rochester, N. Y.....	89,363	Trenton, N. J.....	29,910
Alleghany, Pa.....	78,681	Peoria, Ill.....	29,315
Indianapolis, Ind.....	75,074	Evansville, Ind.....	29,280
Richmond, Va.....	63,803	Bridgeport, Conn.....	29,148
New Haven, Conn.....	62,882	Erie, Pa.....	27,730
Lowell, Mass.....	59,485	Quincy, Ill.....	27,275
Worcester, Mass.....	58,295	New Bedford, Mass.....	26,875
Troy, N. Y.....	56,747	Terre Haute, Ind.....	26,040
Kansas City, Mo.....	55,813	Lancaster, Pa.....	25,769
Cambridge, Mass.....	52,740	Wilkesbarre, Pa.....	23,339
Syracuse, N. Y.....	51,791	Augusta, Ga.....	23,023
Columbus, O.....	51,665	Des Moines, Iowa.....	22,408
Paterson, N. J.....	50,887	Dubuque, Iowa.....	22,254
Toledo, O.....	50,143	Auburn, N. Y.....	21,924
Fall River, Mass.....	49,006	Holyoke, Mass.....	21,851

Area and Population of the Continents.—The area of the five continents of the globe, with its population according to the last census taken, is given in the following table:

	Area.	Population.
Europe.....	3,830,357 square miles.....	312,000,000
Asia.....	16,415,758 “.....	765,000,000
Africa.....	11,556,650 “.....	188,000,000
N. and S. America.....	16,014,058 “.....	87,000,000
Australia.....	4,388,025 “.....	4,000,000

Population, Etc., of the States and Territories.—In the following interesting table will be found the population and area in square miles of all the United States and Territories, likewise the electoral vote and date of admission to the Union of each of the several States:

STATES.	Popu- lation.	Area in Square Miles.	Electoral Vote.	Admitted to the Union.
Alabama.....	1,262,794	50,722	10	Dec. 4, 1818.
Arkansas.....	802,564	52,198	7	June 15, 1836.
California.....	864,686	188,981	8	Sept. 9, 1850.
Colorado.....	194,649	104,500	3	July 4, 1876.
Connecticut*.....	622,683	4,674	6	Jan. 9, 1788.
Delaware*.....	146,654	2,120	3	Dec. 7, 1787.
Florida.....	267,351	59,268	4	March 3, 1845.
Georgia*.....	1,539,048	58,000	12	Jan. 2, 1788.
Illinois.....	3,078,769	55,410	22	Dec. 3, 1818.
Indiana.....	1,978,362	33,809	15	Dec. 11, 1816.
Iowa.....	1,624,620	55,045	13	Dec. 28, 1846.
Kansas.....	995,966	81,313	9	Jan. 29, 1861.
Kentucky.....	1,648,708	37,600	13	June 1, 1792.
Louisiana.....	940,103	41,346	8	April 8, 1812.
Maine.....	648,945	31,776	6	March 4, 1820.
Maryland*.....	934,632	11,184	8	April 28, 1788.
Massachusetts*.....	1,783,012	7,800	14	Feb. 6, 1788.
Michigan.....	1,636,331	56,451	13	June 26, 1837.
Minnesota.....	780,806	83,531	7	Feb. 26, 1858.
Mississippi.....	1,131,592	47,156	9	Dec. 10, 1817.
Missouri.....	2,168,804	65,350	16	March 2, 1821.
Nebraska.....	452,433	75,995	5	March 1, 1867.
Nevada.....	62,265	112,090	3	March 21, 1864.
New Hampshire*.....	346,984	9,280	4	June 21, 1788.
New Jersey*.....	1,130,983	8,320	9	Dec. 18, 1787.
New York*.....	5,083,810	47,000	36	June 26, 1788.
North Carolina*.....	1,400,047	50,704	11	Nov. 21, 1789.
Ohio.....	3,198,239	39,964	23	Nov. 30, 1802.
Oregon.....	174,767	95,244	3	Feb. 14, 1859.
Pennsylvania*.....	4,282,786	46,000	30	Dec. 12, 1787.
Rhode Island*.....	276,528	1,306	4	May 29, 1790.
South Carolina*.....	995,622	29,385	9	May 23, 1788.
Tennessee.....	1,542,463	45,600	12	June 1, 1796.
Texas.....	1,592,574	237,504	13	Dec. 29, 1845.
Vermont.....	332,286	10,212	4	March 4, 1791.
Virginia*.....	1,512,806	40,904	12	June 26, 1788.
West Virginia.....	618,443	23,000	6	Dec. 31, 1863.
Wisconsin.....	1,315,480	53,924	11	March 3, 1848.
Total of States.....	49,369,595	2,054,666	401	
District of Columbia.....	177,638	60		
TERRITORIES.				
Arizona.....	40,441	113,916	...	
Dakota.....	135,180	147,490	...	
Idaho.....	32,611	90,932	...	
Montana.....	39,157	143,776	...	
New Mexico.....	118,430	121,201	...	
Utah.....	143,906	80,056	...	
Washington.....	75,120	69,944	...	
Wyoming.....	20,788	93,107	...	
Total United States.....	50,152,866	2,915,048	...	

* One of the thirteen original States.

Area, Population, Etc., of the Principal Countries of the World.—In the following table are given the area, population, national debt, and names of capitals of the principal countries of the world:

COUNTRY.	Sq. Miles.	Population.	National Debt.	Capital.
Chinese Empire.....	3,924,627	433,000,000	Unknown	Pekin.
British Empire.....	7,778,347	237,391,788	\$3,888,907,980	London.
Russian Empire.....	8,404,767	86,952,347	2,840,597,635	St. Pet'sb'rgh.
United States.....	3,026,504	50,152,559	1,942,172,295	Washington.
German Empire.....	208,744	42,727,262	3,000,000,000	Berlin.
Austria-Hungary.....	240,940	37,700,000	1,625,096,042	Vienna.
France.....	204,096	36,905,738	3,513,724,650	Paris.
Japan.....	156,604	33,200,000	145,000,000	Tokio.
G't Britain and Ireland..	121,230	34,160,000	3,888,907,980	London.
Turkey.....	860,562	31,669,147	1,212,772,200	Const'tin'ple.
Italy.....	114,406	27,769,475	1,977,117,845	Rome.
Spain.....	105,775	10,835,506	2,401,612,001	Madrid.
Brazil.....	13,275,326	10,108,291	368,351,139	R. de Janeiro.
Mexico.....	761,640	9,276,079	395,000,000	Mexico.
Persia.....	648,000	6,500,000	No Debt.	Teheran.
Morocco.....	260,000	600,000	3,000,000	Morocco.
Siam.....	310,000	5,700,000	No Debt.	Bangkok.
Roumania.....	49,262	5,376,000	90,000,000	Burcharest.
Belgium.....	11,373	5,336,185	232,684,553	Brussels.
Egypt.....	212,600	5,250,000	450,000,000	Cairo.
Portugal.....	35,812	4,441,037	428,997,613	Lisbon.
Norway and Sweden....	170,980	4,429,713	39,241,142	Stockholm.
Canada.....	3,483,952	3,602,321	112,248,378	Ottawa.
Holland (Netherlands)...	12,680	3,579,529	391,242,322	Amsterdam.
Abyssinia.....	158,000	3,000,000	Unknown.	Magdalla.
Colombia.....	432,400	2,951,211	15,390,304	Bogota.
Switzerland.....	15,991	2,776,035	6,225,000	Berne.
Peru.....	502,760	2,669,945	213,402,630	Lima.
Chili.....	130,977	2,375,971	60,741,469	Santiago.
Denmark.....	14,553	1,912,142	52,000,000	Copenhagen.
Norway.....	122,280	1,806,900	13,526,128	Christiana.
Venezuela.....	368,235	1,784,197	62,659,687	Caraccas.
Bolivia.....	500,870	1,742,352	17,500,000	Chuquisaca.
Argentine Republic.....	871,000	1,715,681	68,416,043	Buenos Ayres.
Servia.....	18,787	1,720,270	5,000,000	Belgrade.
Greece.....	19,941	1,457,894	98,012,000	Athens.
Guatemala.....	40,778	1,190,754	3,877,384	Guatemala.
Ecuador.....	218,984	1,100,000	17,500,000	Quito.
Hayti.....	29,000	1,000,000	548,022	P't au Prince.
Liberia.....	25,000	1,000,000	Unknown.	Monrovia.
San Salvador.....	9,500	600,000	5,000,000	San Salvador.
Uruguay.....	70,000	455,000	43,615,000	Montevideo.
Nicaragua.....	49,000	300,000	9,000,000	Nicaragua.
Paraguay.....	57,223	221,000	12,098,417	Ascuncion.
Honduras.....	47,092	351,700	37,000,000	Comeazagua.
Costa Rica.....	21,495	185,000	12,000,000	San Jose.

Length of the Principal Rivers.—*In Europe.*—The Danube, 1,800 miles; Dnieper, 1,260; Don, 1,120; Rhine, 691; Elbe, 800; Rhone, 650; Volga, 2,800.

In Asia.—Ganges, 1,970; Irrawaddy, 2,600; Indus, 2,300; Euphrates, 1,750; Amoor, 2,800; Yang-tse-Kiang, 3,300; Hoang-Ho, 2,700; Zambesi, 800; Yenesi, 3,250; Obi, 2,700.

In Africa.—Nile, 2,500; Niger, 2,600; Senegal, 1,900; Gambia, 1,700.

In America.—Missouri to the Mississippi, 3,100; Missouri to the Gulf, 4,350; Mississippi, 3,160; Amazon, 3,600; River De La Plata, 2,240; St. Lawrence, 2,100; Orinoco, 1,600; Rio Grande, 1,800.

Presidential Vote for Sixty Years.—The following table gives the popular and electoral votes for Presidents of the United States, from 1824 to 1884 inclusive, likewise the name of each candidate and of the party to which he belonged:

<i>Year.</i>	<i>Name of Candidate.</i>	<i>Party.</i>	<i>Popular vote.</i>	<i>Elec. vote.</i>
1824	Andrew Jackson.....	Democrat.....	155,872	99
"	John Q. Adams.....	Federal.....	105,321	84
"	W. H. Crawford.....	Republican.....	44,282	41
"	Henry Clay.....	".....	46,587	37
1828	Andrew Jackson.....	Democrat.....	647,231	178
"	John Q. Adams.....	Republican.....	509,097	83
1832	Andrew Jackson.....	Democrat.....	687,502	219
"	Henry Clay.....	National Republican.....	530,189	49
"	John Floyd.....	Whig.....		11
"	William Wirt.....	".....		7
1836	Martin Van Buren.....	Democrat.....	761,549	167
"	W. H. Harrison.....	Whig.....	736,656	73
"	Hugh L. White.....	".....		26
"	Daniel Webster.....	".....		14
"	W. P. Mangam.....	".....		11
1840	Martin Van Buren.....	Democrat.....	1,128,702	40
"	W. H. Harrison.....	Whig.....	1,275,011	234
"	J. G. Birney.....	Liberal.....	7,059	..
1844	James K. Polk.....	Democrat.....	1,337,243	170
"	Henry Clay.....	Whig.....	1,299,068	105
"	J. G. Birney.....	Liberal.....	62,300	..
1848	Zachary Taylor.....	Whig.....	1,360,099	163
"	Lewis Cass.....	Democrat.....	1,220,544	127
"	Martin Van Buren.....	Free Soil.....	291,263	..
1852	Franklin Pierce.....	Democrat.....	1,601,474	254
"	Winfield Scott.....	Whig.....	1,386,578	42
"	John P. Hale.....	Free Soil.....	155,825	..
1856	James Buchanan.....	Democrat.....	1,838,169	174
"	John C. Fremont.....	Republican.....	1,341,262	114
"	Millard Fillmore.....	American.....	874,534	8
1860	Abraham Lincoln.....	Republican.....	1,866,352	180
"	S. A. Douglass.....	Democrat.....	1,375,157	72
"	J. C. Breckenridge.....	".....	845,763	39
"	John Bell.....	Union.....	589,581	12
1864	Abraham Lincoln.....	Republican.....	2,216,067	212
"	Geo. B. McClellan.....	Democrat.....	1,808,725	21
1868	U. S. Grant.....	Republican.....	3,015,071	214
"	Horatio Seymour.....	Democrat.....	2,709,613	71
1872	U. S. Grant.....	Republican.....	3,597,070	286
"	Horace Greeley.....	Liberal and Democrat....	2,834,079	..
"	Charles O'Connor.....	Democrat.....		..
"	James Black.....	Temperance.....		..
1876	R. B. Hayes.....	Republican.....	4,033,295	185
"	Samuel J. Tilden.....	Democrat.....	4,284,265	184
"	Peter Cooper.....	Greenback.....	81,737	..
"	G. C. Smith.....	Prohibition.....	9,522	..
"	Scattering.....		2,636	..
1880	James A. Garfield.....	Republican.....	4,454,416	214
"	W. S. Hancock.....	Democrat.....	4,444,952	155
"	James B. Weaver.....	Greenback.....	308,578	..
1884	James G. Blaine.....	Republican.....	4,851,981	182
"	Grover Cleveland.....	Democrat.....	4,874,986	219
"	Benjamin F. Butler.....	Greenback.....	175,370	..
"	John P. St. John.....	Prohibition.....	150,369	..

Railroads in the United States.—We have 120,000 miles of railroad in operation. They are capitalized, cost and water, at \$10,000,000,000. Their income is many times greater than that of the United States Government.

Presidential Statistics.—The names of all the Presidents of the United States, with date of birth, inauguration and death, likewise the name of the State in which born, are given in the following table:

	<i>Born.</i>	<i>Inaugurated.</i>	<i>Died.</i>	<i>Native of</i>
George Washington	Feb. 22, 1732	April 30, 1789	Dec. 14, 1799	Virginia.
John Adams.....	Oct. 30, 1735	March 4, 1797	July 4, 1826	Mass.
Thomas Jefferson...	April 2, 1743	" 4, 1801	July 4, 1826	Virginia.
James Madison.....	Mar. 16, 1751	" 4, 1809	June 28, 1836	"
James Monroe.....	April 2, 1759	" 4, 1817	July 4, 1831	"
John Quincy Adams	July 11, 1767	" 4, 1825	Feb. 23, 1848	Mass.
Andrew Jackson...	Mar. 15, 1767	" 4, 1829	June 8, 1845	S. Carolina.
Martin Van Buren...	Dec. 5, 1782	" 4, 1837	Dec. 27, 1862	New York.
Wm. H. Harrison..	Feb. 9, 1773	" 4, 1841	April 4, 1841	Virginia.
*John Tyler.....	Mar. 20, 1790	April 5, 1841	Jan. 17, 1862	"
James K. Polk.....	Nov. 2, 1795	March 4, 1845	June 15, 1849	N. Carolina.
Zachary Taylor.....	Nov. 24, 1790	" 4, 1849	July 9, 1850	Virginia.
*Millard Fillmore..	May 7, 1800	July 10, 1850	March 8, 1874	New York.
Franklin Pierce....	Nov. 23, 1804	March 4, 1853	October 8, 1869	New Hamp.
James Buchanan...	April 23, 1791	" 4, 1857	June 1, 1868	Pennsylva.
Abraham Lincoln...	Feb. 12, 1809	" 4, 1861	April 15, 1865	Kentucky.
*Andrew Johnson..	Dec. 29, 1808	April 15, 1865	July 31, 1875	N. Carolina.
Ulysses S. Grant....	April 27, 1822	March 4, 1869	July 23, 1885	Ohio.
Rutherf'd B. Hayes.	Oct. 4, 1822	" 5, 1877		"
James A. Garfield..	Nov. 19, 1831	" 4, 1881	Sept. 19, 1881	"
*Chester A. Arthur.	Oct. 5, 1830	Sept. 19, 1881		Vermont.
Grover Cleveland...	Mar. 13, 1837	March 4, 1885		N. Jersey.

* Elected Vice-Presidents, and succeeded to the Presidency upon the death of the President.

Area and Depth of Inland Seas.—In the following table are given the area and depth of the principal lakes and inland seas of the world:

<i>Name.</i>	<i>Size.</i>	<i>Depth.</i>
Caspian Sea.....	176,000 square miles.	250 feet.
Sea of Aral.....	30,000 "	100 "
Dead Sea.....	303 "	200 "
Lake Baikal.....	12,000 "	750 "
Lake Superior.....	32,000 "	1,000 "
Lake Michigan.....	22,400 "	1,000 "
Lake Huron.....	21,000 "	1,000 "
Lake Erie.....	10,815 "	204 "
Lake Ontario.....	6,800 "	330 "
Lake Nicaragua.....	6,400 "	300 "
Lake Titacana.....	3,012 "	800 "
Salt Lake.....	1,875 "	1,400 "
Lake Tchad.....	14,000 "	250 "
Lake Ladoga.....	12,000 "	1,200 "

Area of Oceans.—The area of the five oceans of the globe is as follows:

Pacific.....	71,000,000 square miles.
Atlantic.....	30,000,000 "
Indian... ..	28,000,000 "
Antarctic.....	8,500,000 "
Arctic	4,500,000 "

Census of the United States.—The following table exhibits the population of the United States according to each census taken:

1st. 1790.....	3,929,328	6th. 1840.....	17,069,452
2d. 1800.....	5,305,925	7th. 1850.....	23,191,876
3d. 1810.....	7,239,814	8th. 1860.....	31,443,327
4th. 1820.....	9,638,131	9th. 1870.....	38,553,371
5th. 1830.....	12,866,026	10th. 1880.....	50,152,806

Height of Mountains.—The height in feet and miles of the highest mountains on the globe is thus given:

	<i>Feet.</i>	<i>Miles.</i>
Kunchainyunga, Himalayas.....	28,178	5 $\frac{3}{8}$
Sorata, Andes, highest in America.....	25,380	5
Illimani, Bolivia.....	21,780	4 $\frac{1}{8}$
Quimborazo, Ecuador.....	21,444	4 $\frac{3}{8}$
Hindoo-Koosh, Afghanistan.....	20,000	3 $\frac{3}{4}$
Coropaxi, Ecuador.....	19,408	3 $\frac{1}{2}$
Antisana, Ecuador.....	19,150	3 $\frac{1}{2}$
St. Elias, British America.....	18,000	3 $\frac{1}{2}$
Poecatapeti volcano, Mexico.....	17,735	3 $\frac{1}{8}$
Mt. Rea, Hawaii.....	16,000	3
Mt. Brown, highest Rocky Mountain peak.....	15,900	3
Mont Blanc, highest in Europe.....	15,776	3
Mowna Roas, Owhyhee.....	15,700	3
Mount Rosa, Alps, Sardinia.....	15,550	3
Pinchinca, Ecuador.....	15,200	2 $\frac{3}{4}$
Mt. Whitney, Cal.....	15,000	2 $\frac{3}{4}$
Mount Fairweather, Russian possessions.....	14,796	2 $\frac{3}{4}$
Mount Shasta, California.....	14,450	2 $\frac{3}{4}$
Pikes Peak, Colorado.....	14,320	2 $\frac{3}{4}$
Mount Ophir, Sumatra.....	13,800	2 $\frac{3}{8}$
Fremont's Peak, R. M., Wyoming.....	13,579	2 $\frac{3}{8}$
Long's Peak, R. M., California.....	13,400	2 $\frac{1}{2}$
Mount Ranier, Washington Territory.....	13,000	2 $\frac{1}{2}$
Mount Ararat, Armenia.....	12,700	2 $\frac{3}{8}$
Peak of Teneriffe, Canaries.....	12,236	2 $\frac{1}{4}$
Miltzin, Morocco.....	12,000	2 $\frac{1}{4}$
Mount Hood, Oregon.....	11,570	2 $\frac{1}{4}$
Simplon, Alps.....	11,542	2 $\frac{1}{4}$
Mount Lebanon, Syria.....	11,000	2 $\frac{1}{8}$
Mount Perdu, France.....	10,950	2
Mount St. Helen's, Oregon.....	10,158	1 $\frac{7}{8}$
Mount Etna, Sicily.....	10,050	1 $\frac{7}{8}$
Olympus, Greece.....	9,754	1 $\frac{3}{4}$
St. Gothard, Alps.....	9,080	1 $\frac{3}{4}$
Pilate, Alps.....	9,050	1 $\frac{3}{4}$
Mount Sinai, Arabia.....	8,000	1 $\frac{1}{2}$
Pindus, Greece.....	7,677	1 $\frac{1}{2}$
Black Mountain, New Caledonia.....	6,467	1 $\frac{1}{4}$
Mount Washington, New Hampshire.....	6,234	1 $\frac{1}{4}$
Mount Marcy, New York.....	5,467	1
Mount Hecla, Iceland.....	5,000	1
Ben Nevis, Scotland.....	4,400	$\frac{3}{4}$
Mansfield, Vermont.....	4,280	$\frac{3}{4}$
Peaks of Otter, Virginia.....	4,260	$\frac{3}{4}$
Ben Lawers, Scotland.....	4,030	$\frac{3}{4}$
Parnassus, Greece.....	3,950	$\frac{3}{4}$
Vesuvius, Naples.....	3,932	$\frac{3}{4}$
Stromboli.....	3,859	$\frac{3}{4}$
Snowdon, England.....	3,500	$\frac{3}{4}$
Ben Lomond.....	3,280	$\frac{3}{4}$
Mount Carmel.....	2,000	
Gibraltar.....	1,470	

The Area and Population of China.—The area of China proper measures 1,348,870 square miles, being about half the size of Europe, seven times that of France, and fifteen times that of Great Britain. Each of the eighteen provinces, therefore, is on an average almost as large as England. Though not so densely peopled as at one time supposed—mistaken estimates having been circulated by travelers who had not penetrated the country away from seaboard or river—it is yet thickly populated. The population of China probably exceeds 200,000,000 of “Celestials.” Interesting information regarding China and the Chinese will be found in the department of “Travels, Manners and Customs, Etc.”

A Useful Table.—The following table shows the number of days from a given date in one month to the same date in any other month:

FROM	TO	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
January.....		365	31	59	90	120	151	181	212	243	273	304	334
February.....		334	365	28	59	89	120	150	181	212	242	273	303
March.....		306	337	365	31	61	92	122	153	184	214	245	275
April.....		275	306	334	365	30	61	91	122	153	183	214	244
May.....		245	276	304	335	365	31	61	92	123	153	184	214
June.....		214	245	273	304	334	365	30	61	92	122	153	183
July.....		184	215	243	274	304	335	365	31	62	92	123	153
August.....		153	184	212	243	273	304	334	365	31	61	92	122
September.....		122	153	181	212	242	273	303	334	365	30	61	91
October.....		92	123	151	182	212	243	273	304	335	365	31	61
November.....		61	92	120	151	181	212	242	273	304	334	365	30
December.....		31	62	90	121	151	182	212	243	274	304	335	365

Example.—To find the number of days from June 16th to October 16th:
In the left hand column find June. Run your eye along to the right until it reaches the column headed October at the top. At the intersection of the two columns you will find the answer, 122 days.

Locomotion of Animals and Velocity of Bodies.—The following table is interesting as showing the average power of locomotion of animals as compared with the velocity of various bodies:

	Per hour.	Per second.
A man walks.....	3 miles,	or 4 feet.
A horse trots.....	7 "	or 10 "
A horse runs.....	20 "	or 20 "
Steamboat runs.....	13 "	or 26 "
Sailing vessel runs.....	10 "	or 14 "
Slow rivers flow.....	3 "	or 4 "
Rapid rivers flow.....	7 "	or 10 "
A moderate wind blows.....	7 "	or 10 "
A storm moves.....	20 "	or 32 "
A hurricane moves.....	80 "	or 117 "
A rifle ball moves.....	1,000 "	or 1,466 "
Sound moves.....	743 "	or 1,142 "
Light moves.....	192,000 miles	per second.
Electricity moves.....	288,600 "	" " "

The astounding velocity of electricity and light in comparison with that of other bodies, may well excite surprise and wonder.

Height of Monuments, Towers and Structures.—The height, in feet, of the most lofty monuments and other structures in the world is given in the following table:

	<i>Feet.</i>		<i>Feet.</i>
Washington Monument, Washing-		Notre Dame Cathedral, Munich.....	343
ton, D. C.....	555	Dome of the Invalides, Paris.....	347
Pyramid of Cheops, Egypt.....	543	Magdeburg Cathedral.....	337
Antwerp Cathedral, Belgium.....	476	St. Mark's Church, Venice.....	328
Strasbourg Cathedral, France.....	474	Assinelli Tower, Bologna.....	314
Tower of Utrecht, Holland.....	464	Bartholdi Statue, New York.....	305
St. Stephen's Steeple, Vienna.....	460	Trinity Church, New York.....	283
Pyramid of Cephnes, Egypt.....	456	Brooklyn Bridge Towers.....	281
St. Martin's Church, Bavaria.....	456	Column at Delhi, India.....	262
St. Peter's, Rome.....	448	Porcelain Tower, China.....	242
Salisbury Spire, England.....	410	Canterbury, Tower, England.....	235
St. Paul's, London, England.....	404	Notre Dame Cathedral, Paris.....	232
St. Peter's, at Hambro'.....	395	Bunker Hill Monument.....	220
Cathedral at Florence, Italy.....	384	Leaning Tower, Pisa, Italy.....	202
Cremona Cathedral, Italy.....	372	Monument, London.....	202
Seville Cathedral, Spain.....	360	Monument, Place Vendome, Paris.....	153
Pyramid of Sakkarah, Egypt.....	356	Trajan's Pillar, Rome.....	151

Distances from Washington to Various Points.—The air line distances from the city of Washington, D. C., to the various points indicated are given in the following table:

	<i>Miles.</i>		<i>Miles.</i>
Alexandria, Egypt.....	5,275	Manilla, Phil. Islands.....	9,360
Amsterdam, Holland.....	3,555	Mecca, Arabia.....	6,593
Athens, Greece.....	5,005	Muscat, Arabia.....	7,600
Auckland, New Zealand.....	8,290	Monrovia, Liberia.....	3,645
Algiers, Algeria.....	3,423	Morocco, Morocco.....	3,305
Berlin, Prussia.....	3,847	Mourzouk, Fezzan.....	5,525
Berne, Switzerland.....	3,730	Mozambique, Moz.....	7,348
Brussels, Belgium.....	3,515	Ottawa, Canada.....	462
Batavia, Java.....	11,118	Panama, New Gran.....	1,825
Bombay, Hindostan.....	8,548	Parana, A. C.....	4,733
Buenos Ayres, A. C.....	5,013	Port au Prince, Hayti.....	1,425
Bremen, Prussia.....	3,500	Paris, France.....	3,485
Constantinople, Turkey.....	4,880	Pekin, China.....	8,783
Copenhagen, Denmark.....	3,895	Quebec, Canada.....	601
Calcutta, Hindostan.....	9,348	Quito, Ecuador.....	2,531
Canton, China.....	9,000	Rio Janeiro, Brazil.....	4,280
Cairo, Egypt.....	5,848	Rome, Italy.....	4,365
Cape Town, Cape Colony.....	6,684	St. Petersburg, Russia.....	4,296
Cape of Good Hope.....	7,380	Stockholm, Sweden.....	4,055
Caraccas, Venezuela.....	1,865	Shanghai, China.....	8,600
Charlotte Town, P. E. I.....	820	Singapore, Malay.....	11,300
Dublin, Ireland.....	3,076	St. John's, N. F.....	1,340
Delhi, Hindostan.....	8,368	San Domingo, S. D.....	4,300
Edinburgh, Scotland.....	3,275	San Juan, Nicaragua.....	1,740
Frederickton, N. B.....	670	San Salvador, A. C.....	1,650
Gibraltar, Spain.....	3,150	Santiago, Chili.....	4,970
Glasgow, Scotland.....	3,215	Spanish Town, Jamaica.....	1,446
Halifax, N. S.....	780	Sydney, C. B. I.....	975
Hamburg, Germany.....	3,570	Sydney, Australia.....	8,963
Havana, Cuba.....	1,130	St. Paul de Loanda.....	5,573
Honolulu, S. I.....	4,513	Timbuctoo, Soudan.....	3,395
Jerusalem, Palestine.....	5,493	Tripoli, Tripoli.....	4,425
Jamestown, St. Helena.....	7,150	Tunis, Tunis.....	4,240
Lima, Peru.....	3,515	Toronto, Canada.....	343
Lisbon, Portugal.....	3,190	Venice, Italy.....	3,835
Liverpool, England.....	3,228	Vienna, Austria.....	4,115
London, England.....	3,313	Valparaiso, Chili.....	4,934
City of Mexico, Mexico.....	1,867	Vera Cruz, Mexico.....	1,680
Montevideo, Uruguay.....	5,003	Warsaw, Poland.....	4,010
Montreal, Canada.....	471	Yeddo, Japan.....	7,680
Madrid, Spain.....	3,485	Zanzibar, Zanzibar.....	7,078
Moscow, Russia.....	4,466		

Distances from New York to Important Cities.—The following are the distances from New York City, as the crow flies, to the points indicated:

	<i>Miles.</i>		<i>Miles.</i>
Albany, N. Y.....	146	Newport, R. I.....	160
Atlanta, Ga.....	1,000	Omaha, Neb.....	1,430
Baltimore, Md.....	185	Philadelphia, Pa.....	87
Boston, Mass.....	236	Pittsburg, Pa.....	431
Buffalo, N. Y.....	469	Portland, Me.....	344
Burlington, Vt.....	301	Providence, R. I.....	183
Charleston, S. C.....	764	Raleigh, N. C.....	538
Chicago, Ill.....	898	Richmond, Va.....	353
Cincinnati, Ohio.....	744	Rochester, N. Y.....	401
Cleveland, Ohio.....	588	Salt Lake City, Utah.....	2,430
Denver City, Col.....	1,980	San Francisco, Cal.....	3,306
Detroit, Mich.....	679	Savannah, Ga.....	854
Galveston, Tex.....	1,800	Saratoga Springs, N. Y.....	183
Harrisburg, Pa.....	182	St. Louis, Mo.....	1,090
Hartford, Conn.....	133	St. Paul, Minn.....	1,450
Indianapolis, Ind.....	838	Washington, D. C.....	225
Little Rock, Ark.....	1,400	Calcutta, India.....	8,300
Long Branch, N. J.....	36	Dublin, Ireland.....	3,130
Louisville, Ky.....	845	Edinburgh, Scotland.....	3,586
Memphis, Tenn.....	1,200	Frankfort, Germany.....	3,530
Milwaukee, Wis.....	1,100	Havana, Cuba.....	1,930
Mobile, Ala.....	1,352	London, England.....	3,206
Montgomery, Ala.....	1,220	Madrid, Spain.....	3,140
Nashville, Tenn.....	1,019	Montreal, Canada.....	401
Newark, N. J.....	9	Paris, France.....	3,567
Newburg, N. Y.....	53	Rio de Janeiro, Brazil.....	4,550
New Haven, Conn.....	76	Rome, Italy.....	4,396
New Orleans, La.....	1,597	St. Petersburg, Russia.....	4,860

Chronological History of Discovery and Progress.—1180—*Glass* first used for windows.

1200—*Mariner's Compass* first used.

1234—*Coal* first dug for fuel.

1240—*Spectacles* invented.

1302—*Paper* first made from linen rags.

1320—*Gunpowder* invented.

1436—*Printing* invented

1457—*Almanacs* first printed by Purbach, in Vienna. *Newspaper*, first in the world issued, called *The Gazette*, printed at Nuremburg.

1462—*Metal Type* in matrices first made by Peter Schœffer, at Nuremburg. *Bible* first printed, at Mentz.

1471—*Printing Press* first set up, by Caxton.

1473—*Musical Notes* first used, but not printed until 1502.

1476—*Watches* first made at Nuremberg.

1516—*Post-office* first established for general public use, between Vienna and Brussels.

1517—*The True System of the Universe*, discovered by Copernicus. Luther began to preach in the same year.

1521—*Luther* summoned before the Diet of Worms.

1526—*Xavier*, the first great missionary of modern Christianity, planted the cross in India.

1527—*Wood Engraving* invented by Albert Durer.

1530—*Spinning Wheel* set in motion by Jergens.

1532—*Henry VIII*, of England, finally and forever broke with the Pope.

- 1535—*Ignatius Loyola* founded the Order of the Jesuits. *First English Bible*. (Coverdale's).
- 1545—*Modern Needles* first came into use.
- 1552—*Books of Geography and Astronomy* destroyed in England, as being infected with magic.
- 1555—*Wheeled Carriages* first used in France.
- 1559—*Steel Knives* first used in England, and *Coaches* introduced about the same time.
- 1562—*Religious Liberty* granted to the Huguenots in France, and was followed by the *Massacre of St. Bartholomew*, 1572.
- 1568—*Clocks* first made in England.
- 1590—*Telescopes* were invented, and the first was probably used in England in 1603. *Spencer, Shakespeare, Bacon, Kepler, Tycho Brahe*, were contemporaries in this year.
- 1607—*First Settlement in America*, Jamestown, Virginia.
- 1615—*Daily Newspaper* first issued, *Frankfort Gazette*. Still published.
- 1616—*Potatoes* landed in Ireland by Sir Walter Raleigh, said to have been brought by him, with tobacco, from Virginia.
- 1622—*The First Newspaper* was published in England; the first attempt at Parliamentary reporting in 1641; the first advertisement appeared in 1648; and the first paper devoted exclusively to advertisements and shipping in 1657.
- 1629—*Printing Press* first introduced into the United States, at Cambridge, Mass.
- 1650—*First Air Pumps* manufactured.
- 1670—*Organs* first introduced into churches by Pope Vitalianus.
- 1690—*First American Newspaper* published at Boston, September 25th, a monthly sheet, headed "Publick Occurrences, Foreign and Domestick." Soon suppressed.
- 1702—*First English Daily Newspaper* published in London, and was called *Daily Courant*. Gas first used for illuminating.
- 1704—*Newspaper* first permanently printed in America, at Boston, called *Boston News-Letter*.
- 1711—*Piano-forte* invented by Father Wood, an English monk at Rome.
- 1731—*First French Newspaper* published at Paris, called *Gazette de France*. *First Public Library* established, at Philadelphia, July 31st.
- 1736—*Union Fire Company*, Philadelphia, organized December 7th, the first volunteer fire company in America, and probably in the world.
- 1751—*Pennsylvania Hospital*, established February 7th; the first in America.
- 1752—*Fire Insurance Company* first formed in America, "The Philadelphia Contributionship." *Lightning Rods* first used. Put up by Benjamin Franklin at his house in Philadelphia. *Theatre* first opened in America, at Williamsburg, Va.
- 1753—*Steam Engine* first introduced into use in America, and was brought from England.
- 1777—*American Flag* adopted by Congress.
- 1780—*Sunday Schools* first established by Robert Raikes, in Gloucester, England.
- 1781—*Bank of North America* incorporated at Philadelphia, May 26th. First banking institution in America. Capital \$400,000.
- 1783—*Balloon* ascension first made, June 5th, near Lyons, France.
- 1784—*Daily Paper* first published in the United States, *The Pennsylvania Packet, or General Advertiser*.

- 1786—*Vessel* navigated first by steam, Philadelphia, July 20th, by John Fitch.
- 1787—*Copper Cent* first coined at New Haven, Conn.
- 1803.—*Steel Pens* first made.
- 1807—*First Steamboat* plied the Hudson, the *Clermont*, by Robert Fulton.
- 1811—*Lead Pencils* first made in the United States, by William Munroe, at Concord, Mass.
- 1813—*Coal* first mined in Philadelphia, sold at \$21 per ton. There are \$50,-000,000 worth now produced annually. *Electric Light* first made practical by Sir Humphrey Davy.
- 1815—*First religious newspaper*, the *Boston Record*, established.
- 1816—*Pins* first manufactured in the United States.
- 1818—*Steamer* first crossed the Atlantic, the *Savannah*, from New York to Liverpool, in twenty-six days.
- 1824—*Steam Ferry Boats* first used between New York and Brooklyn.
- 1825—*Gas* first used in New York for illuminating purposes. *Homæopathy* introduced into the United States. *Passenger Railroad* first opened, September 27th, in England.
- 1826—*Kerosene* first used for illuminating purposes. *Railroad*, first in United States, extended from granite quarries at Quincy, Mass., to Neponset River, three miles. Now nearly 100,000 miles in the United States.
- 1828—*Passenger Railroad*, first in America opened, the Baltimore & Ohio.
- 1829—*Lucifer Matches* first made; came into general use about 1834.
- 1830—*Steam Railroad*, first in New York State, was from Albany to Schenectady, 23 miles. *Iron Steamship* first built. *Omnibuses* first introduced for travel in New York City.
- 1832—*Telegraph* invented by Morse.
- 1838—*Telegraph Wire* of any practical importance first in England, was laid from Paddington to West Drayton; the first in Scotland in 1841; and in Ireland 1854. *Passenger Steamships* began regular voyages across the Atlantic; the *Sirus*, from London to New York, in 17 days, and the *Great Western*, from Bristol to New York, in 15 days.
- 1839—*Envelopes* first used for letters, etc.
- 1840—*Postage-Stamps* first used in England.
- 1844—*Telegraph Wire* first laid in America was between Washington and Baltimore. *Anæsthesia* discovered.
- 1846—*Sewing-Machine* patented, by Elias Howe.
- 1847—*Postage-Stamps* first used in the United States.
- 1848—*Gold* first discovered in California.
- 1853—*Crystal Palace*, N. Y., opened. Burned Oct. 5, 1858.
- 1858—*Cable Dispatches* first sent across Ocean.
- 1863—*Emancipation* proclamation.
- 1866—*Atlantic Cable* successfully laid.
- 1871—*Great Fire* in Chicago.
- 1877—*Telephone* first put into public use. *Phonograph*, Edison's, first brought to public attention.
- 1878—*Elevated Railroad* commenced running in New York City, August 26th.
- 1883—*Brooklyn Bridge* opened May 24th. Cars began to run September 2d.
- 1884.—Discovery of *Cocaine*, the most remarkable of anæsthetics.
- 1885—*The Bartholdi Statue* erected upon Bedloe's Island, New York.

Popular Sobriquets of American States, Cities, Etc.—*Acadia*, the original, and now the poetic, name of Nova Scotia.

Athens of America, a name sometimes given to Boston, Mass.

Budger State, a name popularly given to the State of Wisconsin.

Bay State, a popular name of Massachusetts, which was originally called the Colony of Massachusetts Bay.

Bayou State, a name sometimes given to the State of Mississippi, which abounds in bayous, or creeks.

Bear State, a name by which the State of Arkansas is sometimes designated, on account of the number of bears that infest its forests.

Blue Hen, The, a cant or popular name for the State of Delaware.

Buckeye State, the State of Ohio, popularly so called from the Buckeye tree, which abounds there.

City of Brotherly Love; Philadelphia is sometimes so called, this being the literal signification of the name.

City of Churches, a name popularly given to the City of Brooklyn, New York, from the unusually large number of churches which it contains.

City of Elms, a familiar denomination of New Haven, Conn., many of the streets of which are thickly shaded with lofty elms.

City of Magnificent Distances, a popular designation given to the city of Washington, the capital of the United States, which is laid out on a very large scale.

City of Notions, a popular name for Boston.

City of Rocks, a descriptive name popularly given to the city of Nashville, Tenn.

City of Spindles, a name popularly given to the city of Lowell, Mass., the largest cotton-manufacturing town in the United States.

City of the Straits, a name popularly given to Detroit, Mich., which is situated on the west bank of the river or strait connecting Lake St. Clair with Lake Erie. Detroit is a French word, meaning "strait."

Columbia, a name often given to America, from a feeling of poetic justice to its discoverer. The application of the term is usually restricted to the United States.

Corn-Cracker, The, a popular nickname or designation for the State of Kentucky. The inhabitants of the State are often called Corn-crackers.

Cradle of Liberty, a popular name given to Faneuil Hall, a large public edifice in Boston, Mass.

Creole State, a name sometimes given to the State of Louisiana, in which the descendants of the original French and Spanish settlers constitute a large proportion of the population.

Crescent City, a popular name for the city of New Orleans.

Dark and Bloody Ground, The, an expression often used in allusion to Kentucky, of which name it is said to be the translation.

Diamond State, a name sometimes given to the State of Delaware, from its small size and great worth, or supposed importance.

Empire City, the city of New York, the chief city of America.

Empire State, a popular name of the State of New York, the most populous and the wealthiest State in the Union.

Excelsior State, the State of New York, sometimes so called from the motto, "Excelsior," upon its coat of arms.

Fall City; Louisville, Ky., popularly so called from the falls which, at this place, impede the navigation of the Ohio River.

- Father of Waters*, a popular name given to the river Mississippi on account of its great length (3,160 miles), and the very large number of its tributaries, of which the Red, the Arkansas, the Ohio, the Missouri, the Illinois, the Des Moines, the Wisconsin, and the St. Peter's or Minnesota, are the most important. The literal signification of the name, which is of Indian origin, is said to be "great river."
- Flour City*, a popular designation of the city of Rochester, N. Y., a place remarkable for its extensive manufactories of flour.
- Flower City*; Springfield, Ill., the capital of the State, which is distinguished for the beauty of its surroundings.
- Forest City*; Cleveland, O., so called from the many ornamental trees with which the streets are bordered. Also, a name given to Portland, Me., a city distinguished for its many elms and other beautiful shade trees.
- Freestone State*, the State of Connecticut, sometimes so called from the quarries of freestone which it contains.
- Garden City*, a popular name for Chicago, a city which is remarkable for the number and beauty of its private gardens.
- Garden of the West*, a name usually given to Kansas, but sometimes applied to Illinois and others of the Western States, which are all noted for their productiveness.
- Garden of the World*, a name frequently given to the vast country, comprising more than 1,200,000 square miles, which is drained by the Mississippi and its tributaries—a region of almost unexampled fertility.
- Gate City*; Keokuk, Ia., popularly so called. It is situated at the foot of the lower rapids of the Mississippi (which extend twelve miles, with a fall of twenty-four feet), and is the natural head of navigation. A portion of the city is built on a bluff one hundred and fifty feet high.
- Gibraltar of America*, a name often given to the city of Quebec, which, from its position and natural and artificial means of defense, is the most strongly fortified city in America.
- Gotham*, go'tham, a popular name for the city of New York, first given to it in "Salmagundi" (a humorous work by Washington Irving and William Irving and James K. Paulding), because the inhabitants were such wiseacres.
- Granite State*, a popular name for the State of New Hampshire, the mountainous portions of which are largely composed of granite.
- Green-Mountain State*, a popular name of Vermont, the Green Mountains being the principal mountain range in the State.
- Hawkeye State*, the State of Iowa, said to be so named after an Indian chief, who was once a terror to voyageurs to its borders.
- Hoosier State*, hoo'zhur, the State of Indiana, the inhabitants of which are often called Hoosiers. This word is a corruption of husher, formerly a common term for a bully throughout the West.
- Hub of the Universe*, a burlesque and popular designation of Boston, Mass., originating with the American humorist, Oliver Wendell Holmes.
- Iron City*, a name popularly given to Pittsburgh, Pa., a city distinguished for its numerous and immense iron manufactures.
- Key of the Gulf*, a name often given to the island of Cuba, from its position at the entrance of the Gulf of Mexico.
- Keystone State*, the State of Pennsylvania, so called from its having been the central State of the Union at the time of the formation of the Constitution. If the names of the thirteen original States are arranged in the form of an arch, Pennsylvania will occupy the place of the keystone.

King of Waters, a name given to the River Amazon, in South America.

Lake State, a name popularly given to the State of Michigan, which borders upon the four lakes, Superior, Michigan, Huron, and Erie.

Land of Steady Habits, a name by which the State of Connecticut is sometimes designated, in allusion to the moral character of its inhabitants.

Little Rhody, a popular designation of Rhode Island, the smallest of the United States.

Lone Star State, the State of Texas, so called from the device on its coat of arms.

Lumber State, a popular designation for the State of Maine, the inhabitants of which are largely engaged in cutting and rafting lumber, or of converting it into boards, shingles, scantling, and the like.

Mason and Dixon's Line, a name given to the southern boundary line of the free State of Pennsylvania, which separated it from the slave States of Maryland and Virginia. It was run—except about twenty-two miles—by Charles Mason and Jeremiah Dixon, two English mathematicians and surveyors, between November 15, 1763, and December 26, 1767. During the excited debate in Congress, in 1820, on the question of excluding slavery from Missouri, the eccentric John Randolph, of Roanoke, made great use of this phrase, which was caught up and re-echoed by every newspaper in the land, and thus gained the celebrity which it still maintains.

Modern Athens, a name often given to Boston, Mass., a city remarkable for the high intellectual character of its citizens and for its many excellent literary, scientific, and educational institutions and publications.

Monumental City, the city of Baltimore, so called from the monuments which it contains.

Mother of Presidents, a name frequently given to the State of Virginia, which has furnished six Presidents to the Union.

Mother of States, a name sometimes given to the State of Virginia, the first settled of the thirteen States which united in the Declaration of Independence.

Mound City, a name popularly given to St. Louis on account of the numerous artificial mounds that occupied the site on which the city is built.

Nutmeg State, a popular name for the State of Connecticut, the inhabitants of which have such a reputation for shrewdness that they have jocosely been accused of palming off wooden nutmegs on unsuspecting purchasers, instead of the genuine article.

Old Colony, a name popularly given to that portion of Massachusetts included within the original limits of the Plymouth colony, which was formed at an earlier date than the colony of Massachusetts Bay. In 1692, the two colonies were united in one province, bearing the name of the latter, and, at the formation of the Federal Union, became the State of Massachusetts.

Old Dominion, a popular name for the State of Virginia. The origin of this term has been differently accounted for by different writers.

Old North State, a popular designation of the State of North Carolina.

Palmetto State, the State of South Carolina, so called from the arms of the State, which contain a palmetto.

Panhandle, The, a fanciful and cant name given to the most northerly portion of the State of West Virginia—a long, narrow projection between the Ohio River and the western boundary of Pennsylvania.

Peninsula State, the State of Florida, so called from its shape.

Pine Tree State, a popular name of the State of Maine, the central and northern portions of which are covered with extensive pine forests.

Prairie State, a name given to Illinois, in allusion to the wide-spread and beautiful prairies, which form a striking feature of the scenery of the State.

Puritan City, a name sometimes given to the city of Boston, Mass., in allusion to the character of its founders and early inhabitants.

Quaker City, a popular name of Philadelphia, which was planned and settled by William Penn, accompanied by a colony of English Friends.

Queen City, a popular name of Cincinnati, so called when it was the undisputed commercial metropolis of the West.

Queen City of the Lakes, a name sometimes given to the city of Buffalo, N. Y., from its position and importance.

Queen of the Antilles, an appellation sometimes given to Cuba, which, from its great size, its rich natural productions, its fine harbors, its varied and beautiful scenery, and its commanding geographical position, ranks first among all the islands of the West Indian group.

Queen of the West, a name sometimes given to Cincinnati.

Railroad City: Indianapolis, the capital of the State of Indiana, is sometimes called by this name, as being the terminus of various railroads.

Salt River, a cant name for an imaginary river up which defeated political parties are supposed to be sent to oblivion.

Smoky City, a name sometimes given to Pittsburgh, an important manufacturing city of Pennsylvania.

Sucker State, a cant name given to the State of Illinois, the inhabitants of which are very generally called suckers throughout the West.

Turpentine State, a popular name for the State of North Carolina, which produces and exports immense quantities of turpentine.

Wolverine State, the State of Michigan, popularly so called from its abounding with wolverines.

Incorrect Language.—To expose the mistakes of contented ignorance is hopeless. There is no cure for these but a general improvement in education. There are, however, errors which well-instructed persons sometimes fall into, from mere habit or thoughtlessness. Such errors, like the "fears of the brave and the follies of the wise," have only to be brought home to the consciousness of those who commit them to be discarded at once.

A very common mistake, even with good writers and speakers, is the substitution of *had* for *would*, before the adverbs *rather*, *sooner*, *better*, *lief*, and some others. "I had rather stay than go," instead of "I would rather." "I had as lief take one as the other," instead of "I would as lief." The origin of the error is evident enough. The two words *had* and *would* have the same contracted form when combined with a pronoun. "I'd rather" may be a contraction of either "I would rather," or "I had rather." This contracted form is that which we almost always use in common speech. Even when we are inclined to lengthen it, we rarely give the full pronunciation. We say "I'd rather," leaving the verb doubtful to the listener's ear, and perhaps to ourselves. When driven to write it, we feel naturally inclined to take the shortest word, without much regard to the strict grammatical meaning of the phrase. That the expressions "I had rather" and "I had as lief" are incorrect, will be made evident by simply converting *rather* into its synonym *more willingly*, and *lief* into the corresponding *gladly*.

Yet it must be admitted that these incorrect forms are warranted by such high authorities, from Shakespeare to some of the best writers of our own day, that they are entitled to be regarded, if not as established idioms, at least as tolerated solecisms.

The confusion of *lay* with *lie*, and of *set* with *sit*, is among the most common errors of speech, though well-educated persons are usually able to avoid it in writing. Every one who is familiar with the idiom of our language knows, or ought to know, that *lay* and *set* are what are called transitive verbs, and that *lie* and *sit* are intransitive. In other words, the two former can take a noun after them in the objective case, and the two latter cannot. We say, "Lay the book down;" "Set the post up." To say, "Lie the book," or "Sit the post," would be ridiculous. The error usually committed is in the opposite direction—the transitive verbs being used in an intransitive sense. Many persons, not deficient in education would say, "Some of the children are laying on the grass, and the others are setting in the parlor." That the error prevails in the very highest circles of society and of scholarship cannot be doubted when we find it allowed to mar the effect of one of the finest verses in Byron's well-known apostrophe to the ocean.

"Man's steps are not upon thy paths; thy fields
Are not a spoil for him; thou dost arise
And shake him from thee; the vile strength he wields
For earth's destruction thou dost all despise,
Spurning him from thy bosom to the skies,
And send'st him, shivering in thy playful spray,
And howling to his gods, where haply lies
His petty hope in some near port or bay,
And dashed him again to earth—there let him lay."

Next let us note the persistency with which many well-educated, as well as most uneducated persons, use the objective pronouns *me*, *her*, *him*, *them*, after the various tenses of the substantive verb *to be*, in spite of the injunctions of grammarians. The habit of saying, "It is me," "It is him," instead of "It is I," "It is he," is so universal and so fixed that some modern writers on English philology have been disposed to regard it as allowable.

Possibly to the same cause we may ascribe the general disuse, in ordinary speech, of *whom* as the objective case of *who*. Instead of "the man whom I met," almost every one would say, "the man that I met;" or, more briefly, "the man I met." Both of these modes of expression are in accordance with grammatical rules. Not so is the equally common form of interrogation, "Who did you meet?" "Who were you speaking to?" Here *whom* would be correct, and yet would seem so stiff, that many who know the right would yet pursue the wrong way deliberately. A little alteration of the phrase, in such a case, will often make it more satisfactory in every way; as, for example, "Who was the person you were speaking to?"

The word *anticipate* is frequently misused in the sense of *expect*. Thus: "I anticipate seeing her this evening." Now, "*anticipate*" means, by derivation, to take beforehand, and its proper meaning in English is to take first possession of, or to take before the proper time. A man may anticipate another in doing something which both intend doing; that is, he may succeed in doing it first. But his looking forward to doing either of these acts is not anticipation; it is expectation. "*Particle*" is strangely used to mean "at all," or "degree," as we very colloquially use "*bit*." Thus

"Did I hurt you?" asks a gentleman who has accidentally stumbled against another. "Not a particle," is the answer. He means not at all. Particle literally means the smallest possible division of matter; and it is so material and mechanical in its signification, that the use of it to express degree, and especially degree of pleasure or pain, is, to say the very least, in the worst possible taste. Remember and recollect are not synonymous terms, since we all remember many things which we cannot readily recollect, or re-collect. Therefore the expression, "I don't remember, but I will try to recollect," is not only correct, but it sets forth a condition of the mind expressible in no other way, and to speak of which we have frequent necessity. The pronoun "their" is commonly misused with reference to a singular noun. "If a person is poor, they should make the best of it," writes a would-be moralist. This is an extreme instance of the straits to which we are driven by the lack in English of a pronoun of common gender meaning both he and she, his and her. But, admitting this lack, the fact remains that his is the representative pronoun, as mankind includes both men and women. To use "his or her" in cases of this kind is to the last degree pedantic. Many people use the word ascetic as if it meant elegant, refined. Describing the library of a gentleman of fashion, it is said that "It was just such a collection of books as a man of his ascetic tastes would select." Now ascetic really means austere, rigid. A hermit's habits of life are ascetic. The writer of the sentence just quoted should have substituted the word luxurious, or cultivated.

Children closely follow the example of their elders, particularly if said example chances to be a bad one. It would be better for our youth if its teachers corrected the slang and mistakes of everyday life, and illustrated the rules they teach; for one child in a class speaking impure language will certainly infect the rest. The children of some households speak with a refined method, as if by instinct, but it will generally be traced to parents, for we are all influenced by our surroundings. A child lately questioned in Sunday school admitted, "I done it," and a young man immediately after remarked, "They've went," instead of "They have gone." By such teaching children are unconsciously influenced. Well-bred persons usually speak slowly, with proper emphasis and without abbreviations. Every man cannot possess a rich, full voice; it is a heritage of some families, and refreshing to listen to among the shrill, thin voices one meets so often. But cultivation does a great deal, and nothing is more useful than to think of each word and speak the simplest language without haste, yet at the same time without drawl or affectation. The abandonment of superfluous adjectives would greatly improve our language. I was talking of a poem to a young girl lately, and she said it was "elegant," and when I described a new kind of taffy she said it was "perfectly lovely." There was neither sense nor reason in this mixture of terms. Another young girl is very pretty until she opens her mouth. Then her first words are likely to be, "Land sakes!" or "Clara an' me are goin'," clipping words and misplacing them till one is reminded of poor Hannah Jane, who spelled kiss with one s.

The following are examples of exceedingly vulgar yet by no means uncommon errors of speech. The italicized words are the incorrect ones:

The dinner was *ate* in silence. Say eaten.

The doctor has not *came* yet. Say come.

I *see* him last week. Say saw.

I have *rang* several times. Say I have rung, or I rang

Was you reading when I came in? Say were.

She can read better than *me*. Say better than I.

It was given to you and I. Say you and me. You would not say it was given to I, neither should you say "you and I."

I have a *new pair* of gloves. Which is new, the *pair* or the gloves? Say a pair of new gloves.

James lost *near* about ten dollars. Say nearly ten dollars.

I eat this cake. Say ate.

A *summer's* morning is beautiful. Say summer morning.

Simple Rules for Spelling.—Words ending in *e* drop that letter before the termination *able*, as in move, movable; unless ending in *ce* or *ge*, when it is retained, as in change, changeable, etc.

Words of one syllable ending in a consonant, with a single vowel before it, double that consonant in derivatives; as ship, shipping, etc. But if ending in a consonant with a double vowel before it, they do not double the consonant in derivatives; as troop, trooper, etc.

Words of more than one syllable, ending in a consonant preceded by a single vowel, and accented on the last syllable, double that consonant in derivatives; as commit, committed; but except chagrin, chagrined.

All words of one syllable ending in *l*, with a single vowel before it, have double *ll* at the close; as mill, sell.

All words of one syllable ending in *l*, with a double vowel before it, have only one *l* at the close; as mail, sail.

The words foretell, distill, instill and fulfill, retain the double *l* of their primitives. Derivatives of dull, skill, will and full, also retain the *ll* when the accent falls on these words; as dullness, skillful, willful, fullness.

Words of more than one syllable ending in *l* have only one *l* at the close; as delightful, faithful; unless the accent falls on the last syllable; as in befall, etc.

Words ending in *l* double that letter in the termination *ly*.

Participles ending in *ing*, from verbs ending in *e*, lose the final *e*; as have, having; make, making, etc.; but verbs ending in *ee* retain both, as see, seeing. The word dye, to color, however, must retain the *e* before *ing*.

All verbs ending in *ly*, and nouns ending in *ment*, retain the *e* final of the primitives; as brave, bravely; refine, refinement; except words ending in *dge*; as acknowledge, acknowledgment.

Nouns ending in *y*, preceded by a vowel, form their plural by adding *s*; as money, moneys; but if *y* is preceded by a consonant, it is changed to *ies* in the plural; as bounty, bounties.

Compound words whose primitives end in *y*, change the *y* into *i*; as beauty, beautiful.

The Use of Capitals.—1. Every entire sentence should begin with a capital.

2. Proper names, and adjectives derived from these, should begin with a capital.

3. All appellations of the Deity should begin with a capital.

4. Official and Honorary Titles begin with a capital.

5. Every line of poetry should begin with a capital.

6. Titles of books and the heads of their chapters and divisions are printed in capitals.

7. The pronoun I, and the exclamation O, are always capitals.

8. The days of the week, and the months of the year, begin with capitals.
9. Every quotation should begin with a capital letter.
10. Names of religious denominations begin with capitals.
11. In preparing accounts, each item should begin with a capital.
12. Any word of very special importance may begin with a capital.

An Exercise in Pronunciation.—The following rather curious piece of composition was once placed upon a blackboard at a teachers' institute, and a prize of a Webster's Dictionary offered to any person who could read and pronounce every word correctly. The book was not carried off, however, as twelve was the lowest number of mistakes in the pronunciation made: "A sacrilegious son of Belial, who suffered from bronchitis, having exhausted his finances, in order to make good the deficit, resolved to ally himself to a comely, lenient, and docile young lady of the Malay or Caucasian race. He accordingly purchased a calliope and coral necklace of a chameleon hue, and securing a suite of rooms at a principal hotel he engaged the head waiter as a coadjutor. He then dispatched a letter of the most unexceptional caligraphy extant, inviting the young lady to a matinee. She revolted at the idea, refused to consider herself sacrificable to his desires, and sent a polite note of refusal; on receiving which he procured a carbine and bowie-knife, said that he would not now forge letters hymeneal with the queen, went to an isolated spot, severed his jugular vein and discharged the contents of the carbine into his abdomen. The debris was removed by the coroner."

A Glossary of Wall Street Phrases.—Readers interested in stock speculations will find the following vocabulary of terms used in Wall Street worth remembering:

A Bull is one who operates to depress the value of stocks, that he may buy for a rise.

A Bear is one who sells stocks for future delivery, which he does not own at the time of delivery.

Bear Market—When the market is heavy and falling, and lower prices are expected, in consequence of the efforts of the "bear." A "bull market" is the reverse.

Bear the market—i. e., operate for a decline. A bear is naturally "short" of stocks, and expecting to profit by a decline. To "bull the market" is to operate for a rise in values.

Short is when a person or party sells stocks when they have none, and expect to buy or borrow in time to deliver.

Long is when a person or party has a plentiful supply of stocks.

Overloaded is when the Bulls cannot take and pay for the stock they have purchased.

Borrowing and loaning stocks—When a party has sold stock short and has not bought in by the time the delivery must be made, he "borrows" the stock for the purpose of making the delivery, paying the owner the market price on demand, or at a fixed time, the lender of the stock paying the borrower an agreed rate of interest on the money, or the borrower paying the lender an agreed premium for the use of the stock, as the case may be.

Cover, to "cover one's shorts"—Where stock has been sold short and the seller buys it in to realize his profit, or to protect himself from loss, or to make his delivery. This is "covering short sales."

A call—The privilege obtained, for a consideration, of calling for a certain number of shares of stock, at a given price, within a time named.

Carrying stock—Holding stock by a broker for his customers on a margin.

Clique—A combination of operators formed for the purpose of artificially influencing the market by their combined operations.

Corner—When the market is oversold, the shorts, if compelled to deliver, sometimes find themselves in a "corner."

Curbstone Brokers—Men who are not members of any regular organization, and do business mainly upon the sidewalk.

Flyers—Is a small side operation, not employing one's whole capital, or not in the line of his ordinary operations.

Lamb—A very green "outsider" who essays stock speculation.

Limited order—An order to buy and sell within a certain fixed price, above or below which the party giving the order does not wish to go.

Margins—Where one buys or sells for speculation, and deposits with his broker a percentage of value to enable the latter to "carry" the stock and protect him against loss from fluctuations in value.

Milking the streets—The act of cliques or great operators who hold certain stock so well in hand that they cause any fluctuations they please. By alternately lifting and depressing prices, they "milk" the small operators and the outside.

Put—To buy a "put" is to obtain the right, for a consideration, to deliver a stock at a certain agreed price within a given number of days.

Stop order—An order to sell out stock in case it should decline to a certain price or to buy short stock in case it should advance to a certain price. A means adopted by a party "long" or "short" of a stock to limit his loss to a certain figure.

Turn stocks—Consists in buying for cash or regular way and selling a like amount of the same stock at the same time, on "option," thereby making six per cent. interest and difference that may exist at the time between the market price of the stock for cash and an option; or selling for cash and buying on option, when the stock is hard to carry and the holder, hoping for a rise, does not want to get out of it.

Washing—Is where one broker arranges with another to pay a certain stock when he offers it for sale. The bargain is fictitious, and the effort, when not detected, is to keep it quoted and afford a basis for bona-fide sales. It is not countenanced by the rules of exchange, and if discovered renders members engaged in it liable to the penalty of expulsion.

Commerce of the World.—France exports wines, brandies, silks, fancy articles, furniture, jewelry, clocks, watches, paper, perfumery and fancy goods generally.

Italy exports corn, oil, flax, flour, wines, essences, dye-stuffs, drugs, fine marble, soap, paintings, engravings, molasses and salt.

Prussia exports linen, woollens, zinc, articles of copper, iron and brass, indigo, wax, hams, musical instruments, tobacco, wines and porcelain.

Germany exports wool, woollen goods, linens, rags, corn, timber, iron, lead, tin, flax, hemp, wines, wax, tallow and cattle.

Austria exports minerals, raw and manufactured silk thread, glass, wax, tar, nutgall, wine, honey and mathematical instruments.

England exports cottons, woollens, glass, hardware, earthenware, cutlery, iron, metallic wares, salt, coal, watches, tin, silk and linens.

Russia exports tallow, flax, hemp, flour, iron, linseed, lard, hides, wax, duck, cordage, bristles, fur and potash.

Spain exports wines, brandies, iron, fresh and dried fruits, quicksilver, sulphur, salt, cork, saffron, anchovies and woollens.

China exports tea, rhubarb, musk, ginger, borax, zinc, silks, cassia, filigree work, ivory ware, lacquered ware and porcelain.

Turkey exports opium, silks, drugs, gums, dried fruits, tobacco, wines, camels' hair, carpets, shawls, camlets and morocco.

Hindustan exports gold and silver, cochineal, indigo, sarsaparilla, vanilla, jalap, fustic, Campeachy wood, pimento, drugs and dyestuffs.

Brazil exports coffee, indigo, sugar, rice, hides, dried meats, tallow, gold, diamonds and other stones, gums, mahogany and India-rubber.

The West Indies export sugar, molasses, rum, tobacco, cigars, mahogany, dye-woods, coffee, pimento, fresh fruits and preserves, wax, ginger, and other spices.

East India exports cloves, nutmegs, mace, pepper, rice, indigo, gold, dung, camphor, benzine, sulphur, ivory, rattan, sandalwood, zinc and nuts.

The United States export principally agricultural produce, tobacco, cotton, flour, provisions of all kinds, lumber, turpentine, agricultural implements, sewing machines, cotton goods, cutlery, builders' hardware, furniture, locomotives, munitions of war, gold, silver, quicksilver, and so forth.

Curious Facts in Natural History.—Man generally flatters himself that his anatomy is about the highest effort of Divine skill; yet that of the insect is far more complicated. No portion of our organism can compare with the proboscis of the common fly. Man can boast 370 muscles. Lyonet, who spent his whole life in watching a single species of caterpillar, discovered in it 4,000. The common fly has 8,000 eyes, and certain butterflies 25,000. M. Pouchet treats it as an established fact that so fine are the sensory organs of ants, that they converse by means of their antennæ. Consequently the strength and activity of insects far surpasses ours in proportion. In the whole field of natural science there is nothing more astounding than the number of times a fly can clap its wings in a second. As the fly passes through space at the rate of six feet in a second, it must in that point of time vibrate its wings five or six hundred times. But in rapid flight we are required to believe 3,600 is a moderate estimate. The mind is stupefied if it attempts to realize these results.

Toads are not the only animals which have the power of living for a considerable time without nourishment and communication with the external air. Two living worms were found in Spain in the middle of a block of marble which a sculptor was carving into a lion for the royal family. These worms occupied two small cavities, to which there was no inlet that could possibly admit the air. They subsisted, probably, on the marble, as they were of the same color. This fact was verified by Captain Ulloa, a famous Spaniard, who accompanied the French Academicians in their voyage to Peru for the purpose of ascertaining the figure of the earth. He asserts that he saw these two worms. A beetle of the species called capricorn was found in a piece of wood in the hold of a ship at Plymouth. The wood had no external mark of any aperture. We read in the *Affiches de Province*, June, 1772, that an adder was found alive in the center of a block of marble thirty feet in diameter. It was folded nine times round in a spiral line; it was incapable of supporting air, and died a few minutes after. Upon examining the stone, not the smallest trace was to be found by which it could

have glided in, or received it. Misson, in his travels through Italy, mentions a cray-fish that was found alive in the midst of a mass of marble in the environs of Tivoli. M. Peyssonel, king's physician at Guadaloupe, having ordered a pit to be dug at the back of his house, was told by the workmen that live frogs were found by them in beds of petrification. M. Peyssonel, suspecting some deceit, descended into the pit, dug the bed of rock and petrifications, and drew out green frogs, which were alive and exactly similar to what we see every day.

Serpents are said to obey the voice of their master. The trumpet-bird of America follows its owner like a spaniel, and the jacana acts as a guard to poultry, protecting them in the field all day from birds of prey, and escorting them home at night. In the Shetland Isles there is a gull which defends the flock from eagles; it is therefore regarded as the privileged bird. The chamois, bounding over the mountain, are indebted to their safety in no small degree, to a species of pheasants. The bird acts as the sentinel; for as soon as it gets sight of a man, it whistles, upon hearing which, the chamois, knowing the hunters to be near, sets off at full speed. The artifices which partridges and plovers employ to delude their enemies from the nest of their young, may be referred to as a case in point, as well as the adroit contrivances of the hind for the preservation of her young; for when she hears the sound of dogs, she puts herself in the way of the hunter, and starts in a direction to draw them away from her fawns. Instances of the effect of grief upon animals are no less remarkable. The writer already cited says: "I knew a dog that died of sorrow at the loss of his master, and a bullfinch that abstained from singing ten entire months, on account of the absence of its mistress. On her return it immediately resumed its song." Lord Kaimes relates an instance of a canary which, while singing to a mate, hatching her eggs in a cage, fell dead; the female left the nest, and finding him dead, rejected all food, and died by his side.

Toads become torpid in winter and hide themselves, taking no food for five or six months.

Serpents of all species shed their skins annually, like sea-crabs and lobsters.

Turtles and tortoises have their skeletons partly outside in place of within their bodies.

It is believed that crocodiles live to be hundreds of years old. The Egyptians embalmed them.

In South America there is a prolific honey-bee which has not been furnished with a sting.

In the darkest night, fishes pursue their usual movements the same as by daylight.

Seals are as intelligent as dogs, and can be trained to perform many tricks like them.

The head of the rattlesnake has been known to inflict a fatal wound after being severed from the body.

If the eye of a newt is put out, another perfect one is soon supplied by rapid growth.

Fishes have no eyelids, and necessarily sleep with their eyes wide open.

Alligators fall into a lethargic sleep during the winter season, like the toad.

The power of serpents to charm birds and small quadrupeds is a well authenticated fact.

Duration of Life of Various Animals.—Elephant, 100 years and upward; Rhinoceros, 20; Camel, 100; Lion, 25 to 70; Tigers, Leopards, Jaguars and Hyenas (in confinement), about 25; Beaver, 50; Deer, 20; Wolf, 20; Fox, 14 to 16; Llamas, 15; Chamois, 25; Monkeys and Baboons, 16 to 18; Hare, 8; Squirrel, 7; Rabbit, 7; Swine, 25; Stag, under 50; Horse, 20; Ass, 30; Sheep, under 10; Cow, 20; Ox, 30; Swans, Parrots and Ravens, 200; Eagle, 100; Geese, 80; Hens and Pigeons, 10 to 16; Hawks, 30 to 40; Crane, 24; Blackbird, 10 to 12; Peacock, 20; Pelican, 40 to 50; Thrush, 8 to 10; Wren, 2 to 3; Nightingale, 15; Blackcap, 15; Linnet, 14 to 23; Goldfinch, 20 to 24; Redbreast, 10 to 12; Skylark, 10 to 30; Titlark, 5 to 6; Chaffinch, 20 to 24; Starling, 10 to 12; Carp, 70 to 150; Pike, 30 to 40; Salmon, 16; Codfish, 14 to 17; Eel, 10; Crocodiles, 100; Tortoise, 100 to 200; Whale, estimated, 1,000; Queen Bees live 4 years; Drones, 4 months; Worker Bees, 6 months.

Origin of the Names of States.—Maine takes its name from the province of Main in France, and was so called in compliment to the queen of Charles I, Henrietta, its owner.

New Hampshire, first called Laconia, from Hampshire, England.

Vermont, from the Green Mountains. (French: *vert mont*.)

Massachusetts, from the Indian language, signifying the country about the great hills.

Rhode Island gets its name from the fancied resemblance of the island to that of Rhodes in the ancient Levant.

Connecticut's was Monegan, spelled originally Quon-eh-ta-cut, signifying "a long river."

New York was so named as a compliment to the Duke of York, whose brother, Charles II, granted him that territory.

New Jersey was named by one of its original proprietors, Sir George Carter, after the Island of Jersey in the British Channel, of which he was governor.

Pennsylvania, as is generally known, takes its name from William Penn, and the words "sylvania," meaning woods.

Delaware derives its name from Thomas West, Lord De la Ware, governor of Virginia.

Maryland receives its name from the queen of Charles I, Henrietta Maria.

Virginia got its name from Queen Elizabeth, unmarried, or virgin queen.

The Carolinas were named in honor of Charles I, and Georgia in honor of Charles II.

Florida gets its name from Kasquas de Flores, or "Feast of the Flowers."

Alabama comes from a Greek word, signifying "the land of the rest."

Louisiana was so named in honor of Louis XIV.

Mississippi derived its name from that of the great river, which is, in the Natchez tongue, "the father of waters."

Arkansas is derived from the Indian word Kansas, "smoky waters," with the French prefix of "ark"—a bow.

Tennessee is an Indian name, meaning "the river with the big bend."

Kentucky also is an Indian name—"Kain-tuk-æ," signifying "at the head of the river."

Ohio is the Shawnee name for "the beautiful river."

Michigan's name was derived from the lake, the Indian name for fish-weir, or trap, which the shape of the lake suggested.

Indiana's name came from that of the Indians.

Illinois' name is derived from the Indian word "Illini"—men, and the French affix, "ois," making "tribe of men."

Wisconsin's name is said to be the Indian name for a wild, rushing channel.

Missouri is also an Indian name for muddy, having reference to the muddiness of the Missouri River.

Kansas is an Indian word for smoky water.

Iowa signifies in the Indian language "the drowsy ones," and Minnesota "a cloudy water."

Origin of the Names of Countries.—The following countries, it is said, were originally named by the Phœnicians, 'the greatest commercial people in the world. The names, in the Phœnician language, signified something characteristic of the places which they designate.

Europe signifies a country of white complexion, so named because the inhabitants were of a lighter complexion than those of Asia and Africa.

Asia signifies between or in the middle, from the fact that the geographers placed it between Europe and Africa.

Africa signifies the land of corn or ears. It was celebrated for its abundance of corn, and all sorts of grain.

Siberia signifies thirsty or dry—very characteristic.

Spain, a country of rabbits or conies. It was once so infested with these animals that it sued Augusta for an army to destroy them.

Italy, a country of pitch, from its yielding great quantities of black pitch.

Calabria, also, for the same reason.

Gaul, modern France, signifies yellow-haired, as yellow hair characterizes its inhabitants.

The English of Caledonia is a high hill. This was a rugged mountainous province in Scotland.

Hibernia is utmost, or last habitation; for beyond this westward the Phœnicians never extended their voyages.

Britain, the country of tin, great quantities being found on it and adjacent islands. The Greeks called it Albion, which signifies in the Phœnician tongue either white or high mountains, from the whiteness of its shores, or the high rocks on the western coast.

Corsica signifies a woody place.

Sardinia signifies the footsteps of men, which it resembles.

Syracuse, bad savor, so-called from the unwholesome marsh on which it stood.

Rhodes, serpents or dragons, which it produced in abundance.

Sicily, the country of grapes.

Scylla, the whirlpool of destruction.

Ætna signifies a furnace, or dark or smoky.

Origin of Popular Fables.—Few persons are aware that many of the most popular nursery rhymes and stories have an origin quite different from what is usually supposed. Thus, it is generally thought that the story of Cinderella was invented by some one in a happy fit of imagination; but it is said to be founded on facts. The Greek historian and geographer Strabo says that one day as a lady, named Rhodopsis, was bathing in the Nile, the wind carried away one of her sandals and laid it at the feet of the king of Egypt, who was then holding a court of justice in the open air, not far off. His curiosity was excited by the singularity of the event, and by

the elegance of the sandal, and he offered a reward for the discovery of the owner of it. The lady claimed it, and it was found to fit her exactly. She was very beautiful, and the king married her. She is remembered in history as the "rosy-cheeked queen" of Egypt, and she lived 2,000 years before the Christian era.

The story of Blue Beard has also been traced to a historical basis. Giles de Laval, Marshal of France, in 1428, was distinguished for his military abilities, but he rendered himself infamous by his extraordinary impiety and debaucheries, and by murdering his wives. He had a long beard of a blue-black color, whence he was called Blue Beard. He employed those who pretended to be sorcerers to discover hidden treasures, and he corrupted young persons of both sexes to attach them to him, after which he killed them for the sake of their blood, which he used for his incantations. By order of the Duke of Brittany he was burned alive in a field near Nantes, in the year 1440.

Jack the Giant Killer has been supposed to be derived from the wars of King Arthur with his rebellious Cornish vassals, who figure as ogies and giants, while the king appears as Jack. Many more cases may be cited.

"The House that Jack Built" had interesting antecedents. This famous jingling legend, believed to be an imitation of a medieval Hebrew parable in the form of a hymn, was commemorative of the principal events in the history of the Jewish people. The original is to be found in the Jewish collection called the *Sepher Aaggahah*, volume 23, and an interpretation of it was given to the world so far back as 1731, by P. N. Lebrecht, of Leipsic. There are ten verses. The first consists of two lines and a short refrain, thus: "A kid, a kid my father bought for two pieces of money." (Refrain), "A kid, a kid." This refrain is repeated at the end of each verse. The second verse commences with the words: "Then came the cat and ate the kid that my father bought for two pieces of money." The third verse runs: "Then came the dog, and bit the cat that ate the kid," etc. The fourth is: "Then came the staff, and beat the dog, that bit the cat," etc. The fifth is: "Then came the fire and burned the stick, that beat the dog," etc. The sixth is: "Then came the water, and quenched the fire that burned the staff," etc. The seventh is: "Then came the ox, and drank the water, that quenched the fire," etc. The eighth is: "Then came the butcher, and slew the ox, that drank the water," etc. The ninth is: "Then came the angel of death, and killed the butcher, that slew the ox," etc. The tenth and last runs: "Then came the Holy One, blessed be He, and killed the angel of death, that killed the butcher, that slew the ox, that drank the water, that quenched the fire, that burned the staff, that beat the dog, that bit the cat, that ate the kid, that my father bought for two pieces of money; a kid, a kid." It is evident that this is the model of "The House that Jack Built."

Origin of Familiar Quotations.—Thomas Norton is the author of that "cute" saying, "What will Mrs. Grundy say?" while Washington Irving gives us "The Mighty Dollar." "God tempers the wind to the shorn lamb," not infrequently attributed to Scripture writer, is from Lawrence Sterne. Dean Swift says that "Bread is the staff of life," and "A little learning is a dangerous thing." The same sentiment is expressed in Pope's well-known line, "Drink deep, or taste not the Pierian spring." It is not at all unlikely that he derived it from Lord Bacon, who in his "Essay on Atheism," says:

"A little philosophy inclineth man's mind to Atheism, but depth in philosophy bringeth man's mind about to religion." Pope tells us to "shoot folly as it flies;" was it suggested by Dryden's "and shoots their treasons as they fly?"—found in his Absalom. Lady Wortley Montague says: "I admired Mr. Pope's 'Essay on Criticism' at first very much, because I had not then read any of the ancient critics and did not know that it was all stolen." This is, of course, not to be taken literally, but it is a well-known, indisputable fact that poets—and not they only—are imitators and borrowers, and to put it mildly, unconscious plagiarists. Of course, Byron was but jesting when he said to Moore, who, observing a book beside him full of paper marks, asked him what it was, replied: "Only a book from which I am trying to *crib*, as I do whenever I can, and that's the way I got the character of an original poet." He wrote, however, in his journal, "As for originality, all pretensions to it are ridiculous; there is nothing new under the sun."

"Like angels' visits, few and far between," found in Campbell's Pleasures of Hope, seems to be an echo of this from Blair's Grave: "Its visits, like those of angels, short and far between."

Cowper's oft-quoted line,

"England, with all thy faults I love thee still,"

is almost verbatim this found in Churchill's Farewell,

"Be England what she will

With all her faults she is my country still."

"Variety is the spice of life," and "Not much the worse for wear," Cowper. "Man proposes but God disposes," Thomas à Kempis. "Of two evils choose the least," and "The end must justify the means," are from Matthew Prior.

Origin of Genius.—Columbus was the son of a weaver and a weaver himself.

Rabelais, son of an apothecary.

Claude Lorraine was bred a pastry cook.

Moliere, son of a tapestry maker.

Cervantes served as a common soldier.

Homer was a beggar.

Hesiod was the son of a small farmer.

Demosthenes of a cutler.

Terence was a slave.

Richardson was a printer.

Oliver Cromwell, the son of a brewer.

Howard, an apprentice to a grocer.

Benjamin Franklin, a journeyman printer.

Doctor Thomas, Bishop of Worcester, son of a linen draper.

Whitfield, son of an inn-keeper at Gloucester.

Sir Cloudesley Shovel, Rear-Admiral of England, was an apprentice to a shoemaker, and afterward a cabin boy.

Bishop Prideaux worked in the kitchen at Exeter College, Oxford.

Cardinal Wolsey, son of a butcher.

Ferguson was a shepherd.

Neibuhr was a peasant.

Thomas Paine, son of a staymaker at Thetford.

Dean Tucker was the son of a small farmer in Cardignshire, and performed journeys to Oxford on foot.

Edmund Halley was the son of a soap boiler at Shoreditch.

Joseph Hall, Bishop of Norwich, son of a farmer at Ashby de la Zouch.

William Hogarth was put apprentice to an engraver of pewter pots.

Dr. Mountain, Bishop of Durham, was the son of a beggar.

Lucian was the son of a statuary.

Virgil of a potter.

Horace of a shopkeeper.

Plantus, a baker.

Gay was apprenticed to a silk mercer.

Dr. Samuel Johnson was the son of a bookseller at Litchfield.

Akenside, son of a butcher at Newcastle.

Collins, son of a hatter.

Samuel Butler, son of a farmer.

Ben Jonson worked for some time as a bricklayer.

Robert Burns was a plowman in Ayrshire.

Thomas Chatterton, son of the sexton of Redcliffe Church, Bristol.

Thomas Gray was the son of a money scrivener.

Matthew Prior, son of a joiner in London.

Origin of Plants.—The potato is a native of South America, and is still found wild in Peru, Chili, and Montevideo. The first notice of it by Europeans was in 1588. It is now spread over a great part of the world. Wheat and rye originated in Siberia and Tartary, where they are now indigenous. Oats are found wild in Abyssinia, and may be justly considered natural to the country. Maize, or Indian corn, is a native of Mexico and other parts of North America. It was not known in Europe till after the discovery and possession of Mexico by the Spaniards. The bread-fruit tree was first found in Otaheite and other South-sea islands. Near the close of the last century, it was transplanted in the West Indies. Tea is found only in China and Japan. The cocoa-nut is found indigenous in the equatorial regions. Coffee is a native of Arabia, and of that part called Arabia Felix, but is now grown in the East and West Indies. The apple is found on most parts of the globe. But in its wild or natural state, it is merely the crab apple, and has been varied and improved by cultivation. The peach is a native of Persia, but in its natural state is small and bitter, or acid, and considered unwholesome. Tobacco is a native of South America and of Mexico. A species of this plant has been lately found in New Holland. Asparagus was brought from Asia; cabbage and lettuce from Holland; rice from Ethiopia and from the East Indies, and onions from Africa and some parts of Asia. The sugar cane is a native of China, and the manufacture of sugar was known there from the remotest antiquity. It was thence carried to Arabia, thence to Egypt, and thence by the Moors into Spain, and thence to the West Indies and Brazil. Many flowers are from Java and Ceylon, from Cappadocia, from Syria and Italy.

Dying Words of Famous Persons.—"It is well."—Washington.

"I must sleep now."—Byron.

"Head of the army."—Napoleon.

"Don't give up the ship."—Lawrence.

"Let the light enter."—Goethe.

"Independence forever."—Adams.

"Is this your fidelity?"—Nero.

"Give Dayroles a chair."—Lord Chesterfield.

"It is the last of earth."—J. Q. Adams.

"God preserve the emperor."—Haydn.

"A dying man does nothing well."—Franklin.

"Let not poor Nelly starve."—Charles II.

"What, is there no bribing death?"—Cardinal Beaufort.

"All my possessions for a moment of time."—Queen Elizabeth.

"It matters little how the head lieth."—Sir Walter Raleigh.

"Clasp my hand, my dear friend, I die."—Alfieri.

"I feel as if I were to be myself again."—Sir Walter Scott.

"Let me die to the sound of delicious music."—Mirabeau.

"I have loved God, my father and liberty."—Mme. de Stael.

"It is small, very small indeed" (clasping her neck).—Anne Boleyn.

"I pray you see me safe up, and for my coming down let me shift for myself" (ascending the scaffold).—Sir Thomas More.

"Don't let that awkward squad fire over my grave."—Burns.

"I resign my soul to God—and my daughter to my country."—Thomas Jefferson.

"I wish you to understand the true principles of the Government. I wish them carried out. I ask nothing more."—Harrison.

"I have endeavored to do my duty."—Taylor.

"You spoke of refreshment, my Emilie; take my last notes, sit down to my piano here, sing them with the hymn of your sainted mother; let me hear once more those notes which have so long been my solacement and delight."—Mozart.

"God bless you, my dear."—Dr. Johnson.

"God bless you! Is that you, Dora?"—Wordsworth.

"Now it is come."—John Knox.

"Dying, dying."—Hood.

"How grand these rays; they seem to beckon earth to heaven" (the sun was shining brilliantly into the room in which he was lying).—Humboldt.

Idiosyncrasies of Men of Genius.—Most geniuses and men of great talent have been known for some peculiar habit or striking idiosyncrasy. Napoleon would tremble with fear at sight of a cat. General Elliott, of Gibraltar fame, was always accompanied by a number of them. Johnson liked to imbibe floods of tea or wine, and yet be none the worse for it. Porson drank everything that came in his way. Visiting once a friend's house, when evening came they desired to feed the lamp, but the bottle was empty. Porson had drank the spirits on the sly, not knowing it was intended for the lamp. Douglas Jerrold could not bear the smell of apples. Cavenish hated women. If he met one of his own female servants by accident in any part of the house, she was instantly dismissed. Garrick was vain almost to the degree of insanity. Rousseau was vain and could not write except when dressed as a fop. Bulwer Lytton, it is said, could write best when dressed in a court suit. Marlborough was a miser, mended his own stockings to save paying for it, and would walk home ever so late at night rather than pay for a "chair." Napoleon did his "thinking" and formed his plans for conquest while pacing in a garden, shrugging his shoulders now and then as if to help and "compress" thought. When Thiers was engaged in his long and oratorical displays he always had beside him a supply of rum and coffee. The coffee he got direct from Mecca. Gibson dictated while walking in his room, like Scott and many others. Moliere wrote with his knees near the fire, and Bacon liked to study in a

small room, which, he said, helped him to condense his thoughts. George Stephenson used to lie in bed for two or three days, the better to "think out" his plan. It would be better if people do this who have much thinking to do, as rest favors thought, and those who have not a vigorous circulation find the supply of blood to the brain assisted by a recumbent position.

Fate of the Apostles.—Matthew is supposed to have suffered martyrdom, or was put to death by the sword at the city of Ethiopia.

Mark was dragged through the streets of Alexandria, in Egypt, until he expired.

Luke was hanged upon an olive tree in Greece.

John was put in a cauldron of boiling oil at Rome and escaped death. He afterward died a natural death at Ephesus, in Asia.

James the Great was beheaded at Jerusalem.

James the Less was thrown from a pinnacle or wing of the temple and then beaten to death with a fuller's club.

Philip was hanged up against a pillar at Hierapolis, a city of Phrygia.

Bartholomew was flayed alive by the command of a barbarous king.

Andrew was bound to a cross, whence he preached to the people till he expired.

Thomas was run through the body by a lance near Malipar, in the East Indies.

Jude was shot to death with arrows.

Simeon Zelotes was crucified in Persia.

Matthias was first stoned and then beheaded.

Peter was crucified with his head downwards.

Paul, the last and chief of the apostles, also died by violence.

Statistics of the Globe.—The earth is inhabited by about 1,300 millions of inhabitants, viz:

Of the Caucasian race.....	360,000,000
Of the Mongolian.....	550,000,000
Of the Ethiopian.....	190,000,000
Of the Malay.....	200,000,000
Of the American Indian.....	1,000,000

There are about 3,064 languages spoken in the world, and its inhabitants profess more than 1,000 different religions. The number of men is about equal to the number of women. The average of human life is about 33 years. One-quarter die previous to the age of 7 years, one-half before reaching 17, and those who pass this age enjoy a felicity refused one half of the human species. To every 1,000 persons, only 1 reaches 100 years of life; to every 100, only 6 reach the age of 65; and not more than 1 in 500 lives to 80 years of age. There are on the earth 1,000,000,000 inhabitants; of these 33,333,333 die every year, 91,824 every day, 3,730 every hour, and 60 every minute, or 1 every second. The married are longer lived than the single, and above all, those who observe a sober and industrious conduct. Tall men live longer than short ones. Women have more chances of life in their favor previous to their being 50 years of age than men have, but fewer afterward. The number of marriages is in the proportion of 75 to every 1,000 individuals. Marriages are more frequent after the equinoxes, that is, during the months of June and December. Those born in the spring are more robust than others. Births and deaths are more frequent by night than by day. The number of men capable of bearing arms is calculated at one-fourth of the population.

Leading Governments of the World.—Of the leading governments of the world fourteen are constitutional monarchies and thirteen are republics, while nine are despotisms. They may be enumerated as follows:

1. British Empire, constitutional.
2. Denmark, constitutional.
3. Norway and Sweden, constitutional.
4. Russia, despotic.
5. Holland and Belgium, constitutional.
6. Hanover, constitutional.
7. German Empire, constitutional.
8. Switzerland, republic.
9. Austrian Empire, constitutional.
10. France, republic.
11. Spain, constitutional.
12. Portugal, constitutional.
13. Italy, constitutional.
14. Greece, constitutional.
15. Turkish Empire, despotic.
16. Persia, despotic.
17. Afghanistan and Beloochistan, constitutional.
18. Tartary, despotic.
19. Hindostan, constitutional.
20. Indo-China, despotic.
21. Chinese Empire, despotic.
22. Egypt, despotic.
23. Abyssinia, despotic.
24. United States, republic.
25. Mexico, republic.
26. Central America, republic.
27. Granada, republic.
28. Brazil, constitutional.
29. Peru, republic.
30. Bolivia, republic.
31. Chili, republic.
32. Aracania, despotic.
33. La Plata, republic.
34. Paraguay, republic.
35. Uruguay, republic.
36. Hayti, republic.

The Sovereigns of Christendom.—There are at the present moment thirty-six reigning sovereigns in Christendom, from the Queen of England, to whom 237,000,000 of human beings own their allegiance, to the Prince of Monaco, whom 5,742 subjects acknowledge as their leige lord. Of these princes, ten are nominally Roman Catholic, namely, the Emperors of Austria and Brazil, the Kings of Italy, Spain, Portugal, Belgium, Bavaria, Saxony, the Princes of Lichtenstein and Monaco. Of the remaining twenty-six, two belong the Greek Church, though the Czar and the King of the Hellenes belong to different branches of it. The other twenty-four are Protestants, sixteen being called Lutherans, four (including the German Emperor) belonging to the "Evangelical" confession, three to the "reformed" Church, and one being the "supreme head on the earth" of the Church of England, but the vast majority of Queen Victoria's subjects (139,000,000)

are neither Protestant nor Catholics, but Hindoos, while the Mahommedans, 40,000,000 in number, are themselves more numerous than the Protestants of all denominations in the empire.

Wealth of the Presidents.—General Grant, previous to his recent losses, was estimated to be worth \$200,000. Hayes is not rich, though in a well-to-do condition. Andrew Johnson and Abraham Lincoln each left \$50,000. James Buchanan died worth \$200,000. Franklin Pierce entered the White House poor, but went back to Concord worth \$60,000. Millard Fillmore made a snug fortune out of the law, and was comparatively rich when he became President. General Taylor saved his army salary, and was in independent circumstances when elected to the presidency. He held the office hardly a year and a half, and left a property worth \$50,000. Tyler was a bankrupt when the death of Harrison made him President, and he married a fortune in Miss Gardiner. He went out of office a rich man, but he became a leader in the Confederacy and his property was sunk in the general ruin occasioned by the war. James K. Polk had good opportunity to make money before election, and he was an economist by nature. He left \$150,000. Martin Van Buren was the richest of all our Presidents, his estate being estimated at \$800,000. He made money as a lawyer and also as a politician, and his real estate purchases became immensely profitable, but his money has been almost entirely wasted by his heirs. Andrew Jackson was not a money-making man. He lived nine years after the expiration of his term of office, and left only a large landed estate commonly known as the Hermitage. John Quincy Adams was a methodical business man and an economist. He left about \$60,000, which at that time was a large sum. James Monroe was so poor in his old age that he became the guest of his son-in-law, Samuel L. Gouverneur, of New York, where he died. Madison was more successful in taking care of his money, and left his widow a property which enabled her to live handsomely in Washington till the end of her days. Jefferson passed his last days in much distress, and was really afraid that his place would be sold by the sheriff. He was an object of public charity, and subscription was opened in his behalf in New York, but his death occurred so soon that the benevolent effort was not required. Old John Adams left an estate worth \$30,000. Washington was a rich man for his day, his wealth being solely due to marriage. Mount Vernon was not a productive property, but Mrs. Custis brought him a large fortune which she inherited from her first husband. Viewing our Presidents in a mere pecuniary estimate, there are a hundred men in New York each of whom could buy out the whole of them. When one contemplates their true worth, however, one sees how utterly poor mere wealth becomes in comparison.

American Wonders.—The greatest wonder in the world is the Falls of Niagara, where the water from the great upper lakes forms a river of three-quarters of a mile in width, and then, being suddenly contracted, plunges over the rocks, in two columns, to the depth of one hundred and seventy feet each.

The greatest cave in the world is the Mammoth Cave, in Kentucky, where any one can make a voyage on the waters of a subterranean river, and catch fish without eyes.

The largest lake in the world is Lake Superior, which is truly an inland sea, being four hundred and thirty miles long, and one thousand feet deep.

The greatest natural bridge in the world is the Natural Bridge over Cedar Creek, in Virginia. It extends across a chasm eighty feet in width and two hundred and fifty feet in depth, at the bottom of which the creek flows.

The greatest mass of solid iron in the world is the Iron Mountain of Missouri. It is three hundred and fifty feet high, and two miles in circuit.

The greatest suspension bridge in the world is the East River Bridge, connecting the cities of New York and Brooklyn. Its length is more than one mile.

The greatest monument in the world is the Washington Monument, at Washington, D. C. Its height is 555 feet.

The greatest statue in the world is the Bartholdi Statue, on Bedloe's Island, New York Bay, presented to America by the people of France. Its height is 305 feet.

The largest number of whale ships in the world is sent out by Nantucket and New Bedford, Mass.

The greatest grain port in the world is Chicago.

The largest aqueduct in the world is the Croton Aqueduct, in New York. Its length is forty and a half miles, and it cost twelve and a half millions of dollars.

The largest deposits of anthracite coal in the world are in Pennsylvania, the mines of which supply the market with millions of tons annually, and appear to be inexhaustible.

Insignificant Origin of Great Works.—It is not the tools that make the workman, but the trained skill and perseverance of the man himself. Some one asked Opic by what wonderful process he mixed his colors. "I mix them with my brains, sir," was the reply. It is the same with every workman who could excel.

Ferguson made marvelous things—such as his wooden clock, that actually measured the hours, by means of a common penknife, a tool in everybody's hand, but then everybody is not a Ferguson.

A pan of water and two thermometers were the tools by which Dr. Black discovered latent heat; and a prism, a lens, and a sheet of pasteboard enabled Newton to unfold the composition of light and the origin of color.

An eminent foreign savant once called upon Dr. Wollaston, and requested to be shown over his laboratory, in which science had been enriched with so many important discoveries, when the doctor took him into a little study, and pointed to an old tea tray on the table, containing a few watch glasses, test papers, a small balance, and a blow pipe, and said: "There is all the laboratory I have."

Stockhardt learned the art of combining colors by closely studying butterflies' wings; he would often say no one knew how much he owed to these tiny insects.

A burnt stick and a barn door served Wilkie in lieu of pencil and canvas.

Bewick first practiced drawing on the cottage walls of his native village, which he covered with his sketches in chalk; and Benjamin West made his first brushes out of the cat's tail.

Ferguson laid himself down in the fields at night in a blanket, and made a map of the heavenly bodies, by means of a thread with small beads on it, stretched between his eyes and the stars.

Franklin first robbed the thunder cloud of its lightning by means of a kite with two cross sticks and a silk handkerchief.

Watt made his first model of the condensing steam engine out of an old anatomist's syringe, used to inject the arteries previous to dissection.

Gifford worked his first problem in mathematics, when a cobbler's apprentice, upon small scraps of leather which he beat smooth for the purpose, while Rittenhouse, the astronomer, first calculated eclipses on his plow handle.

How Money Accumulates.—The following shows how easy it is to accumulate a fortune, provided proper steps are taken. The table shows what would be the result at the end of fifty years by saving a certain amount each day and putting it at interest at the rate of six per cent:

<i>Daily Savings.</i>	<i>The Result.</i>	<i>Daily Savings.</i>	<i>The Result.</i>
One cent.....	\$ 950	Sixty cents.....	\$ 57,024
Ten cents.....	9,504	Seventy cents.....	66,528
Twenty cents.....	19,006	Eighty cents.....	76,032
Thirty cents.....	28,512	Ninety cents.....	85,537
Forty cents.....	38,015	One dollar.....	95,041
Fifty cents.....	47,520	Five dollars.....	475,208

Nearly every person wastes enough in twenty or thirty years, which, if saved and carefully invested, would make a family quite independent; but the principle of small savings has been lost sight of in the general desire to become wealthy.

How to Calculate Interest.—The following rules are so simple and true that every boy and girl deep in the mysteries of arithmetic should put them by for reference. There being no such thing as a fraction in them, there is scarcely liability to error or mistake:

Six per cent.—Multiply any given number of days of interest desired by the principal; separate the right-hand figure and divide by six; the result is the true interest, in cents, on such sum for such number of days at six per cent.

Eight per cent.—Multiply any given amount for the number of days upon which it is desired to ascertain the interest, and divide by forty-five, and the result will be the interest on such sum for the time required at eight per cent.

Ten per cent.—Multiply the same as above and divide by thirty-six, and the result will be the amount of interest on such sum for the time required at ten per cent.

How Man is Constructed.—The average weight of an adult man is 140 pounds 6 ounces.

The average weight of a skeleton is about fourteen pounds.

Number of bones, 240.

The skeleton measures one inch less than the living man.

The average weight of the brain of a man is three and a half pounds; of a woman, two pounds eleven ounces.

The brain of man exceeds twice that of any other animal.

The average height of an Englishman is five feet nine inches; and of a Belgian, five feet six and three-quarter inches.

The average weight of an Englishman is 150 pounds; of a Frenchman, 136 pounds; a Belgian, 140 pounds.

The average number of teeth is thirty-two.

A man breathes about twenty times a minute, or 1,200 times an hour.

A man breathes about eighteen pints of air in a minute, or upwards of seven hogsheads in a day.

A man gives off 4.08 per cent. carbonic gas of the air he respires; re-spires 10,666 cubic feet of carbonic acid gas in twenty-four hours, equal to 125 cubic inches common air.

A man annually contributes to vegetation 124 pounds of carbon.

The average of the pulse in infancy is 120 per minute; in manhood, 80; at 60 years, 60. The pulse of females is more frequent than that of males.

Remarkable Works of Human Labor.—Nineveh was fourteen miles long, eight miles wide, and forty-six miles round, with a wall one hundred feet high and thick enough for three chariots abreast. Babylon was fifty miles within the walls, which were seventy-five feet thick and one hundred feet high, with one hundred brazen gates. The temple of Diana, at Ephesus, was four hundred and twenty feet to the support of the roof. It was one hundred years in building. The largest of the pyramids was four hundred and eighty-one feet in height, and eight hundred and fifty-three feet on the sides. The base covers eleven acres. The stones are about sixty feet in length and the layers are two hundred and eight. It employed 320,000 men in building the labyrinth in Egypt, and it contains three hundred chambers and twelve halls. Thebes, in Egypt, presents ruins twenty-seven miles round, and contained 350,000 citizens and 400,000 slaves. The Temple of Delphos was so rich in donation that it was plundered of \$50,000,000, and the Emperor Nero carried away from it two hundred statues. The walls of Rome were thirteen miles around.

Atlantic Cables.—Eleven Atlantic cables in all have been successfully laid, and the first two are dead or lost. Of the nine cables, only four are in really good order, the other five being old and having little chance of continued life. The average life of a cable is only ten years. One of the nine was laid in 1869, another in 1873, a third in 1874, a fourth is the cable of 1866, repaired in 1880, while a fifth was laid in 1875. The more recent are the French (Pouyer Quertier) cable of 1879, the two new Gould and the Bonnett and Mackey cables.

The oldest company, the Anglo-American, is the owner of the four oldest cables, including the patched one of 1880. Three of these it laid, while the cable of 1869 was laid by the French company, and came to the Anglo-American when it absorbed that company. These four old cables are represented by a capital of \$12,582,550, preferred 6 per cent. shares, a like amount of deferred shares, and \$9,834,900 of ordinary shares—in all, \$35,000,000. Their total length is 12,319 miles, and the capital is, therefore, \$2,765 per mile.

Largest of Their Kind.—1. The largest ocean in the world is the Pacific. 2. The largest sea is the Mediterranean. 3. River, the Amazon. 4. Gulf, Mexico. 5. Cape, Horn. 6. Lake, Superior. 7. Bay, Bengal. 8. Island, Australia. 9. City, London. 10. Public building, St. Peter's, Rome. 11. Hotel, Palace, San Francisco. 12. Steamer, Great Eastern. 13. Desert, Sahara. 14. Theatre, Grand Opera House, Paris. 15. State, Texas. 16. Territory, Dakota. 17. Park, the Phoenix Park, Dublin. 18. Highest mountain, Kunchainyunga, Himalayas. 19. Sound, Long Island. 20. Largest Railroad, Union Pacific and Central Pacific. 21. Canal, Grand Canal, China. 22. Suspension Bridge, Brooklyn. 23. Largest railroad depot, St. Pancras, London. 24. Largest room in the world under single roof, military one, St. Petersburg. 25. Strongest fort, Gibraltar. 26. Longest ship, the Romsdal. 27. Sailing ship of greatest tonnage, the Three

Brothers. 28. Largest Monument, Washington. 29. Largest statue, Bartholdi.

Marvels of the Microscope.—Leuwenhoeck tells us of animated insects seen with the microscope, of which twenty-seven millions would only be equal to a mite. Insects of various kinds are observable in the cavities of a common grain of sand. Mould is a forest of beautiful trees, with the branches, leaves, flowers and fruit fully discernible. Butterflies are fully feathered. Hairs are hollow tubes. The surface of our bodies is covered with scales like a fish; a single grain of sand would cover 150 of these scales; and a single scale covers 500 pores; yet through these narrow openings the sweat exudes like water through a sieve; how minute, then, must be its particles! The mite makes five hundred steps in a second. Each drop of stagnant water contains a world of animated beings, swimming with as much liberty as whales in the sea. Each leaf has a colony of insects grazing on it like oxen in a meadow.

Measurements of the Great Lakes.—The following measurements of the great lakes have been taken by Government surveyors: The greatest length of Lake Superior is 335 miles; its greatest breadth is 160 miles; mean depth, 688 feet; elevation, 827 feet; area, 82,000 square miles. The greatest length of Lake Michigan is 300 miles; its greatest breadth, 108; mean depth, 690 feet; elevation, 506 feet; area, 23,000 miles. The greatest length of Lake Huron is 300 miles; its greatest breadth is 60 miles; mean depth, 600 feet; elevation, 274 feet; area, 20,000 square miles. The greatest length of Lake Erie is 250 miles; its greatest breadth is 80 miles; its mean depth is 84 feet; elevation, 261 feet; area, 6,000 square miles. The greatest length of Lake Ontario is 180 miles; its greatest breadth is 65 miles; its mean depth is 500 feet; elevation, 261 feet; area, 6,000 square miles. The total of all five is 1,265 miles, covering an area of upward of 135,000 square miles.

Wedding Anniversaries.—Many are interested in marriage anniversaries, and so we give their definitions: First anniversary, iron; fifth anniversary, wooden; tenth anniversary, tin; fifteenth anniversary, crystal; twentieth anniversary, china; twenty-fifth anniversary, silver; thirtieth anniversary, cotton; thirty-fifth anniversary, linen; fortieth anniversary, woolen; forty-fifth anniversary, silk; fiftieth anniversary, golden; seventy-fifth anniversary, diamond.

Nature's Barometers.—Certain movements on the part of the animal creation, before a change of weather, appear to indicate a reasoning faculty. Such seems to be the case with the common garden spider, which, on the approach of rainy or windy weather, will be found to shorten and strengthen the guys of his web, lengthening the same when the storm is over. There is a popular superstition that it is unlucky for an angler to meet a single magpie; but two of the birds together are a good omen. The reason is that the birds foretell the coming of cold or stormy weather; and then, instead of their seaching for food for their young in pairs, one always remains on the nest. Sea gulls predict storms by assembling on the land, as they know that the rain will bring earthworms and larvæ to the surface. This, however, is merely a search for food, and is due to the same instinct which teaches the swallow to fly high in fine weather, and skim along the ground when foul is coming. They simply follow the flies and gnats which

remain in the warm strata of the air. The different tribes of wading birds always migrate before rain, likewise to hunt for food. Many birds foretell rain by warning cries and uneasy actions, and swine will carry hay and straw to hiding places, oxen will lick themselves the wrong way of the hair, sheep will bleat and skip about, hogs turned out in the woods will come grunting and squealing, colts will rub their backs against the ground, crows will gather in crowds, crickets will sing more loudly, flies come into the house, frogs croak and change color to a dingier hue, dogs eat grass, and rooks soar like hawks. It is probable that many of these actions are due to actual uneasiness, similar to that which all who are troubled with corns or rheumatism experience before a storm, and are caused both by the variation in barometric pressure and the changes in the electrical condition of the atmosphere.

Facts Regarding the City of London.—London (with all its suburbs) covers within the fifteen miles radius of Charing Cross nearly 700 square miles. It numbers within these boundaries over 4,000,000 inhabitants. It contains more country-born inhabitants than the counties of Devon and Gloucester combined, or thirty-seven per cent. of its entire population. Every four minutes a birth takes place in the metropolis, and every six minutes a death. Within the circle named there are added to the population 205 persons every day, and 75,000 annually. London has 7,000 miles of streets, and on an average twenty-eight miles of new streets are opened and 9,000 new houses built every year; 1,000 vessels and 9,000 sailors are in port every day. Its crime is also in proportion to its extent. Seventy-three thousand persons are annually taken into custody by the police, and more than one-third of all the crime in the country is committed within its borders. Thirty-eight thousand persons are annually committed for drunkenness by its magistrates. The metropolis comprises considerably upward of 100,000 foreigners from every quarter of the globe. It contains more Roman Catholics than Rome itself, more Jews than the whole of Palestine, more Irish than Belfast, more Scotchmen than Aberdeen, and more Welshmen than Cardiff. Its beershops and gin-palaces are so numerous that their frontages, if placed side by side, would stretch a distance of sixty-two miles. If all the dwellings in London could thus have their frontages placed side by side they would extend beyond the city of York, a distance of 172 miles. London has sufficient paupers to occupy every house in Brighton. The society which advocates the cessation of Sunday labor will be astonished to learn that sixty miles of shops are open every Sunday. With regard to churches and chapels, the Bishop of London, examined before a committee of the House of Lords in the year 1840, said: "If you proceed a mile or two eastwards of St. Paul's, you will find yourself in the midst of a population the most wretched and destitute of mankind, consisting of artificers, laborers, beggars, and thieves, to the amount of 300,000 or 400,000 souls. Throughout this entire quarter there is not more than one church for every 10,000 inhabitants, and in two districts, there is but one church for 45,000 souls."

About Gems.—The finest emeralds come from Peru, and other parts of South America, though they are sometimes brought from the East. They are of a beautiful clear green color, some very dark, others paler, and are much valued and used for ornamental jewelry. The Queen of Spain's emeralds were among the most beautiful jewels shown at the Great Lon-

don Exhibition. Rubies are very striking gems, being, when of the finest sort, of a beautiful dark-red color, and very clear; they are not, however, often of large size, and are not so hard as many other gems—the emerald for instance. There is an inferior kind, of a pale-rose color, which are brought from Balachan, in Turkey.

The sapphire is generally called a blue gem, and that is the color intended when people talk of a “sapphire hue,” but it varies so much in color that there are sapphires which resemble, and as it were, counterfeit other gems; these are called oriental emeralds, topazes; or whatever other stone they resemble. The red sapphire, or oriental ruby, is one of the most valuable gems, coming next after the diamond. Some sapphires present when polished a beautiful effect, from a six-rayed star of light gleaming in their center. This is the effect of the six-sided form of the crystal.

A carbuncle is a gem of a beautiful deep-red color, with a mixture of scarlet, found in the East Indies. It is usually found pure, of an angular figure; its usual size is nearly a quarter of an inch in length, and two-thirds of that in diameter. When held up to the sun it loses its deep tinge, and becomes exactly of the color of a burning coal.

The opal is only partially clear, and its great beauty consists in the play of colors from its interior; yellow, red, and green, the most exquisite tints, flash and gleam from it as it is moved about. The finest opals are as valuable as diamonds; they are brought from Turkey, and sometimes from Hungary, but it is seldom that any are found of large size.

The amethyst is a clear, hard stone of a beautiful violet color by daylight, but looking brown by candlelight; it is nearly related to the quartz rock-crystal, which is used for making spectacle glasses, and sometimes for false diamonds. We get the finest amethysts from Ceylon, the Brazils, and the southern part of Spain. The turquoise is an opaque stone of a blue color; it is very soft in comparison with most gems, and is therefore often used for engraving upon; it is very easily imitated, and, consequently, a large proportion of cheap jewelry pretends to be adorned with turquoises.

The topaz is of a bright golden yellow; the garnet, of a good deep red; the latter is not very valuable, though very pretty. In some places small garnets are crushed to use instead of emery; and in Germany, where garnets are very abundant, they are sometimes used as a flux for iron ore. The topaz is found in several parts of the East Indies, in Ethiopia, Arabia, Peru, and Bohemia; the oriental are the most esteemed. They can easily be imitated.

The Jewels in European Crowns.—The crown of England is believed to be the finest piece of regalia in the world. The lower part of the band is a row of 129 pearls, the upper part of 112; between them, in front, is a large sapphire; behind is a smaller sapphire, with six others and eight emeralds. Between the two great sapphires are ornaments containing 286 diamonds. About the band are eight sapphires, surmounted by eight diamonds and eight festoons, containing 160 diamonds. In the front of the crown is the ruby given to the Black Prince by Pedro, King of Castile. This is set in a Maltese cross, and forming the cross are seventy-five large diamonds. Three other crosses are round the upper part of the crown, containing altogether 386 diamonds. Between the four crosses are four ornaments with four rubies in their centers, and containing respectively eighty-four, eighty-six, eighty-five and eighty-seven diamonds. From the Maltese crosses rise four arches composed of oak leaves and acorns, the leaves con-

taining 728 diamonds. The thirty-two acorns are each of a single pearl, and are set in cups made of fifty-four diamonds. Above the arches stands the mound, containing 548 diamonds, and above the mound is the cross, containing a very large sapphire, four very large and 108 smaller diamonds. The value of the whole is variously estimated, but is commonly believed to be about \$1,500,000.

The jewels of the crown of the King of Portugal are valued at 35,000,000 francs, and his diamonds weigh over 5,000 carats, their value being estimated at more than £2,000,000. Among them is a diamond reported to weigh 1,680 carats, which, if genuine, is the largest stone of the kind in the world. It is, however, suspected to be a white topaz, and the King will not allow a critical examination to be made of it.

At the coronation of the present Czar and Czarina, two crowns were made for the occasion, together with a necklace, and the Empress's crown is thought to present to view the most beautiful collection of diamonds ever gathered in a single ornament. It is uncertain whether Russia or Persia possesses the finest collection of crown diamonds in the world, but the honor belongs to one of the two.

One of the finest collections of crown jewels in the world is possessed by the most hopelessly broken down potentate, the Sultan of Turkey. Every Sultan from the earliest times has made a point of collecting jewels and selling none, and thus, through the course of ages, the collection has become enormous. The jewel-rooms of the Turkish Sultan resemble nothing so much as the descriptions in the "Arabian Nights."

Depth of the Atlantic Ocean.—The main theatre of sounding operations has been the Atlantic Ocean, which from its relation to the leading commercial nations, and for intercontinental telegraph purposes, has been more carefully surveyed than any other great body of water. Open from pole to pole, participating in all conditions of climate, communicating freely with other seas, and covering 30,000,000 square miles, it is believed to represent general oceanic conditions, and to contain depths nearly, if not quite, as great as the other ocean basins of the world, although but little is known, it is true, in this respect of the Indian, Antarctic, and Pacific seas. The general result of its soundings would indicate that the average depth of the Atlantic bed is not much more than 12,000 feet, and that there seem to be few depressions deeper than 15,000 or 20,000 feet, a little more than the height of Mont Blanc. Doctor Thompson sums up the general results of the Atlantic soundings as follows: "In the Arctic sea there is deep water reaching to 9,000 feet to the west and southwest of Spitzbergen. Extending from the coast of Norway, and including Iceland, the Faroe Islands, Shetland and Orkney, Great Britain and Ireland, and the bed of the North sea to the coast of France, there is a wide plateâu, on which the depth rarely reaches 3,000 feet; but to the west of Iceland, and communicating, doubtless, with the deep water in Spitzbergen sea, a trough 500 miles wide, and in some places, nearly 12,000 feet deep, curves along the coast of Greenland. This is the path of one of the great Arctic currents. After sloping gradually to a depth of 3,000 feet to the westward of the coast of Ireland, in latitude 50 degrees, the bottom suddenly dips to 10,000 feet at the rate of about fifteen to nineteen feet in 100; and from this point to within about 200 miles of the coast of Newfoundland, when it begins to shoal again, there is a vast undulating submarine plain, averaging 12,000 feet in depth below the surface—the 'telegraph plateau.' A valley about 500 miles, and with a

mean depth of 15,000 feet, stretches from off the southwest coast of Ireland, along the coast of Europe, dipping into the Bay of Biscay, past the Strait of Gibraltar, and along the west coast of Africa. Opposite the Cape de Verde Islands it seems to merge into a slightly deeper trough, which occupies the axis of the South Atlantic, and passes into the Antarctic sea. A nearly similar valley curves around the coast of North America, about 12,000 feet in depth, off Newfoundland and Labrador, and becoming considerably deeper to the southward, where it follows the outline of the coast of the States and the Bahamas and Windward Islands, and finally joins the central trough of the South Atlantic off the coast of Brazil, with a depth of 15,000 feet.

Consumption of Timber.—To make shoe pegs enough for American use consumes annually 100,000 cords of timber, and to make lucifer matches, 300,000 cubic feet of the best pine are required every year. Lasts and boot-trees take 500,000 cords of birch, beech, and maple, and the handles of tools 500,000 more. The baking of bricks consumes 2,000,000 cords of wood, or what would cover with forest about 50,000 acres of land. Telegraph poles already up represent 800,000 trees, and their annual repairs consume 300,000 more. The ties of railroads consume annually thirty years' growth of 75,000 acres, and to fence all the railroads in the United States would cost \$45,000,000 with a yearly expenditure of \$15,000,000 for repairs. These are some of the ways which American forests are going. There are others; packing-boxes, for instance, cost in 1874 \$12,000,000, while the timber used each year in making wagons and agricultural implements is valued at more than \$100,000,000.

Interesting Facts.—The Atlantic Ocean includes an area of 30,000,000 square miles. Suppose an inch of rain to fall upon only one-fifth of this vast expanse, it would weigh 360,000,000 tons, and the salt which, as water, is held in solution in the sea, and which, when the water was taken up as a vapor, was left behind to disturb the equilibrium, weighed 16,000,000 more tons, or nearly twice as much as all the ships in the world could carry at a cargo each. It might fall in a day; but occupy what time it might in falling, this rain is calculated to exert so much force—which is inconceivably great—in disturbing the equilibrium of the ocean. If all the water discharged by the Mississippi River during the year were taken up in mighty measure, and cast into the ocean at an effort, it would not make a greater disturbance in the equilibrium of the sea than the fall of rain supposed. And yet so gentle are the operations of nature that movements so vast are unperceived.

How Caves Are Formed.—It becomes an interesting question to find out how this subterranean system was made; for in so many cases valley passes into ravine, and that into a cave, that the cause which has formed one must have formed all. It requires but a cursory glance to see at once that running water was the main agent. The limestone is so traversed by joints and lines of shrinkage, that the water sinks rapidly down into its mass, and collects in small streams, which owe their direction to the dip of the water and the position of the fissures. These channels are being continually deepened and widened by the mere mechanical action of the passage of stones and silt. But this is not the only way in which the rock is gradually eroded. The limestone is composed in great part of pure carbonate of lime, which is insoluble in water. It is, however, readily dis-

solved in any liquid containing carbonic acid, which is an essential part of our atmosphere, and is invariably present in the rain-water, and is given off by organic bodies. By this invisible agent, the hard crystalline rock is always being attacked in some form or other. The very snails that take refuge in its crannies leave an enduring mark of their presence in a surface fretted with their acid exhalations, which very often pass current among geologists for the borings of pholades, and are the innocent cause of much speculation as to the depression of the mountain-tops beneath the sea in comparatively modern times. The carbonic acid taken up by the rail is derived in the main from the decomposing vegetable matter which generally forms the surface soil on limestone. Its effects are to be seen in a most marked degree in the bare, gray masses of rock termed "pavements," that stand out like *roches moutonnées* from the purple heather, and are worn and fissured into the strangest possible shapes. Sometimes the surface is made up of a number of sharp points that look like a sheaf of sword-blades; at others, there are ravines and caves in miniature; and very generally the strata are divided into a series of large angular blocks, which work with the greatest freedom. The minute fossil shells and fragments of crinoids standing out in bold relief testify that the agent which removed so much rock is chemical, not mechanical. The invisible agent is equally at work in the caves as well as above ground, everywhere attacking the surface, even out of the reach of the streams. The endless varieties of stalactite and stalagmite are merely so much solid matter taken by it out of the rock, and re-deposited where the excess of carbonic acid in the water happens to be taken up by a free current of air. To it, then, as well as to the mechanical power of the stream, the formation and enlargement of caves must be assigned.

Floating Islands.—Gippsland is a province of Victoria. It is bounded by the Australian Alps on all sides, except on the south, which the sea washes for over one hundred miles. It may be called the Piedmont of Australia; rich, fertile plains, intersected by rivers flowing into a lake system, extending all along the coasts, and separated from the sea by a narrow, sandy ridge, with one navigable opening. A local paper, the *Gippsland Times*, gives the following description of "floating islands" on the lakes:

"As one of the Gippsland Steam Navigation Company's steamers was recently crossing Lake Wellington, the man at the wheel suddenly observed land right in the track of the steamer, apparently only a short distance from the straits separating Lakes Wellington and Victoria. He called the captain's attention to the strange sight, and, on coming close, the land was discovered to be a small island, about thirty yards in length by twenty broad. It was covered by a rich coating of luxuriant grass; and small trees, tea-trees, and bush-shrubs, appeared to be growing in profusion. The only occupants of this remarkable apparition were a few pigs, feeding away contentedly, and apparently enjoying their novel journey by water. A second island of the same description, but much smaller, was noticed a little farther on, but this had evidently detached itself from the larger piece of land, or, most probably, had been separated by the rooting depredations of the porkers.

"From what portion of the mainland this floating island came is, of course, a matter of conjecture, but it is known that a portion of the soil at Marley Point, on the southern shore of Lake Wellington, became detached recently, and floated miles across the lake, with some twenty or thirty head

of pigs aboard. As long as the wind drove in that direction, the island drifted toward M'Lennard's Straits, but a change of wind brought it back again, after a three days' trip, within a mile of the spot from which it had broken away. We believe it is the opinion of the district surveyor that the area of the Roseneath run, West of Lake Wellington, has been increased some twenty or thirty acres by the addition of drift islands."

Business Vocabulary.—*Acceptance.*—A draft drawn on a party and by him indorsed on the face with his agreement to pay it when due.

Account.—A statement of indebtedness, etc.

Acquittance.—A discharge in full.

Ad valorem.—In proportion to value.

Annul.—To cancel.

Assets.—Funds or effects.

Assignment.—A transfer of property on certain conditions for stated purposes.

Assignee.—A person to whom anything is assigned.

Assignor.—The person who assigns.

Balance.—Difference between two statements or accounts.

Bankrupt.—A person unable to pay his debts.

Bill of Exchange.—An order for money to be paid.

Bill of Sale.—A contract signed and sealed for the sale of personal property.

Bills Payable.—Name given to notes made and to be paid by a party.

Bills Receivable.—Notes made and to be paid to a party.

Bond.—An instrument or deed providing a money security.

Capital.—The amount of assets on which a business is carried on.

Check.—An order on a bank for the payment of money.

Capitation.—A tax on every male who is of age.

Commission.—The amount or proportion charged by an agent in a business transaction.

Company.—An association for transacting business.

Consideration.—The sum of money or thing for which a transaction is made.

Consign.—To send goods, etc., to a party.

Consignee.—One to whom goods are consigned.

Consignor.—One who consigns goods.

Contract.—A bargain or agreement.

Conveyance.—A document transferring property.

Days of Grace.—Three days legally allowed beyond the date for payment.

Debit.—To make debtor in an account or books.

Default.—Failure to pay.

Discount.—A sum taken from a bill or note.

Dividend.—Interest on stock investments, etc.

Draft.—An order for the payment of a certain sum.

Drawer.—One who draws a draft, etc.

Drawee.—The person on whom the draft is drawn.

Effects.—Property of every description.

Entry.—A record made in books of account.

Executor.—One appointed to carry out the provisions of a will.

Exhibit.—A writing or official statement.

Face.—The sum named in a note, etc.

Failure.—A bankruptcy.

Firm.—The style or name of a company under which it transacts business.

Foreclose.—To deprive a mortgagor by legal process of his right of redemption.

Goods.—A term applied generally to merchandise, etc.

Gross.—Entire, as gross receipts. Twelve dozen.

Guarantee.—A security.

Honor.—To accept and pay a note, draft, etc.

Hypothecate.—To make a security of.

Indorsement.—A signature on the back of a bill, note, etc.

Insolvent.—Unable to pay all debts.

Interest.—A certain proportion of a sum as profit; a share.

Inventory.—A catalogue, or list.

Joint Stock.—Stock held by more than one person, or in company.

Judgment.—Decree of court to pay in a suit.

Lease.—A usually written contract for hiring of land or buildings.

Legal Tender.—Money decreed by the Government to be legal and a proper means of payment.

Letter of Credit.—A letter giving a certain credit to a person named therein.

Letters Patent.—A written instrument granting certain rights and powers.

Letters of Administration.—The instrument granting authority to administrators.

Lien.—A valid claim by reason of some debt.

Liquidation.—The settling and adjustment of accounts.

Maturity.—The time when a payment is due.

Mortgage.—A conditional conveyance of property giving a right of redemption.

Mortgagor.—One giving such a conveyance.

Mortgagee.—One to whom such a conveyance is given.

Net.—The amount remaining after making all deductions.

Partnership.—An association of two or more persons for the transaction of business.

Par Value.—The face value.

Payee.—The person to whom a payment is due.

Protest.—A notary's official notice of non-payment of a note, draft or check.

Rebate.—A reduction in consideration of prompt payment.

Receipt.—A written acknowledgment of payment.

Salvage.—Compensation for assistance in saving a vessel.

Schedule.—An inventory.

Set-off.—A claim off-setting a debt.

Sight.—The time when a draft is presented.

Suspend.—To stop payment.

Silent Partner.—One who furnishes capital but whose name does not appear in a firm.

Sterling.—The British standard of coinage.

Scrip.—A certificate of joint stock.

Staple.—A standard commodity or production.

Teller.—A bank official who pays out and receives money.

Transfer.—A conveyance of right, property or title.

Voucher.—A document proving a receipt or other fact.

Nautical Vocabulary.—*Abaft*.—Toward the stern.

About.—To take the opposite tack.

Anchor.—The heavy piece of iron which holds the ship at rest.

Alee.—On the side away from the wind.

Aslern.—In the direction of the stern.

Athwart.—In a line across the ship.

Beating.—Sailing against the wind by tacking.

Bow.—The front of a vessel.

Bend.—To fasten; as, to bend on a rope.

Berth.—A ship's anchorage, or a narrow shelf for sleeping on.

Block.—A pulley.

Bolt Rope.—The rope surrounding the sail to which it is sewed.

Brace.—A rope attached to a boom or yard by which they are moved.

Boom.—The spar at the bottom of a sail by which it is extended.

Bulkhead.—A partition within the hull.

Bulwarks.—The sides of a vessel surrounding and extending above the deck.

Cable.—A strong rope or chain.

Caboose.—A kitchen on deck.

Camel.—An arrangement for assisting a ship over shoals.

Carry Away.—To break or lose a rope or spar.

Cat Block.—The tackle block for hoisting the anchor.

Cat's Paw.—A light puff of wind.

Caulk.—To make tight the seams of a vessel.

Clew.—To bind up.

Clew Lines.—Ropes for clewing.

Combings.—The raised edges around the hatches.

Cock Pit.—A room for wounded men in a war vessel.

Companionway.—The cabin stairway.

Compass.—An instrument showing the vessel's course.

Coxswain.—The steerer of a small boat.

Deadlight.—An iron shutter covering a port hole.

Dead Reckoning.—The keeping the course of a vessel with the use of log line and compass.

Deck.—The covering or floor to a ship.

Draught.—The depth of water required to float a vessel.

Fathom.—Six feet.

Fender.—A piece of wood or other material to prevent the contact of two vessels.

Footrope.—A rope extending along and under a yard on which the seamen stand.

Fore and Aft.—From bow to stern.

Forecastle.—That part forward of the foremast.

Foremast.—The mast nearest the bow.

Forge.—To move slowly ahead.

Founder.—To sink.

Furl.—To roll up.

Gaff.—The upper spar holding up a fore and aft sail.

Galley.—The kitchen.

Gangway.—An entrance to a ship.

Grapnel.—A small anchor.

Halyards.—Ropes for hoisting sails.

Hatch, or Hatchway.—An opening in the deck.

Heave to.—To stop by bringing a ship's bow to the wind.

Hold.—The interior of a vessel.

Hull.—The body only of a vessel.

Jaw.—The mast end of a boom or gaff.

- Jib*.—A triangular sail at a ship's bow.
- Jibe*.—To shift a sail from one side to the other.
- Jurymast*.—A temporary mast.
- Keel*.—The lowest timber in a ship.
- Knot*.—A nautical mile.
- Launch*.—To let a ship slide into the water.
- Lead*.—A mass of lead used in sounding.
- Lee*.—Away from the wind.
- Leeway*.—The lee motion or space of water.
- Locker*.—A chest or box.
- Log or Logline*.—A rope used for measuring the speed of a vessel.
- Log or Logbook*.—The ship's record or diary.
- Luff*.—To bring a ship nearer to the wind.
- Manrope*.—A rope used in going up or down the ship's side.
- Mast*.—An upright piece of timber set in a ship for supporting sails, rigging, etc.
- Masthead*.—The head or top of a mast.
- Mess*.—A number of men eating together.
- Midships*.—The middle, or widest part of a ship.
- Mizzenmast; Mizzen sail*.—The hindmost when there are three.
- Moor*.—To secure a ship in any position.
- Nip*.—A short turn, as in a rope.
- Painter*.—A rope used to secure a boat to anything.
- Pay Out*.—To slacken or give out, as to pay out a rope.
- Peak*.—The upper and outer corner of a boom sail.
- Pintle*.—The bolt on which a rudder is hung.
- Port*.—The left hand of a ship looking towards the bow; same as larboard.
- Port or Port Hole*.—An opening in a ship's side to admit light and air.
- Quarter*.—The stern portion of a ship's side.
- Rake*.—The inclination of a mast.
- Reef*.—A portion of the sail which is clewed up when the wind is too high to expose the whole.
- Reef*.—To take up such a portion.
- Reeve*.—To pass the end of a rope through a pulley, etc.
- Rigging*.—A term applied generally to a vessel's ropes, etc.
- Road*.—An open space of water where ships may anchor.
- Rowlock*.—Arrangement for giving purchase to an oar in rowing.
- Rudder*.—The contrivance which steers a vessel.
- Scud*.—To sail before a heavy wind or gale.
- Sail*.—The sheet of canvas which is exposed to the wind and gives motion to the vessel.
- Seams*.—Where the ship's planks join.
- Sheet*.—A rope for controlling and moving a sail.
- Shore*.—A prop under a beam.
- Skipper*.—The name given generally to the master of a small vessel.
- Sloop*.—A vessel with but one mast.
- Sound*.—To ascertain the depth of the water.
- Spar*.—A name applied to a mast, boom, gaff, yard, etc.
- Stern*.—The rear portion of a vessel.
- Starboard*.—The right hand of a ship looking toward the bow.
- Stay*.—A rope supporting or keeping in place a mast.
- Tack*.—To go against the wind in a zig-zag course, and to change a ship's course by shifting her rudder and sails.

Taut.—Tight.

Thwarts.—A boat's seats.

Tiller.—A bar for moving a rudder.

Trick.—A sailor's duration of time in steering.

Warp.—To move a vessel by a line fastened at the end to an anchor.

Watch.—A certain portion of time for duty.

Wake.—The track left in the water by a moving vessel.

Weather.—Toward the wind.

Weigh Anchor.—To raise the anchor.

Waist.—That portion of the deck between the quarter-deck and forecastle.

Windlass.—A machine for raising the anchor or cargo.

Windward.—The point from whence the wind blows.

Yacht.—A sailing vessel used for pleasure.

Yard.—A spar supporting and extending a sail.

Yardarm.—Either half of a yard.

Yaw.—A movement causing a temporary change of course.

Dictionary of Musical Terms.—*Accompaniment.*—A secondary part added to the principal for the improvement of the general effect.

Adagio.—A slow movement.

Ad libitum.—Implies that the time of the movement is left to the discretion of the performer.

Allegretto.—With cheerful quickness.

Andante.—Somewhat sedate; slowly.

Animato, Animaso, or Con Anima.—Animated: with spirit.

Assai.—Very; used as an adverb with another word.

A temp.—In regular time.

Beat.—An indication of a certain duration of time.

Ben.—Implying well, as *Ben marcato*.

Calando.—A gradual diminution in speed and tone.

Chromatic.—Proceeding or formed by semi-tones.

Con.—With; as *Con espressione*.

Crescendo.—A gradual increase in tone.

Da.—By. *Delicato.*—With delicacy.

Dales or Dal.—In a soft, quiet manner.

Doloroso.—In a melancholy, sad style.

Espressivo or Con espressione.—With expression.

Fine.—the end. *Fork, or For.*—Strong, loud.

Furioso.—With great animation. *Giusto.*—In perfect time.

Grave.—The slowest time or movement.

Gusto, Con gusto.—With style; taste. *Il.*—The.

Inpetuoso.—Impetuously. *In.*—In; as *In tempo*.

Intrado, or Introduzione.—An introduction to a piece of music.

Largo.—A slow and solemn degree of time.

Legato.—In a smooth, even manner. *Leggiando.*—Lightly.

Marcato.—In a marked manner. *Meme.*—The same.

Mezzo.—In a medium degree; as *Mezzo forte*.

Moderato.—Moderately. *Malto.*—Very; as *Malto forte*.

Movimento.—Movement; time. *Nobile.*—Grandly; impressively.

Obligato.—An essential portion of a composition.

Ottava or 8va. An octave.

Pedale, or Ped.—Signifies that performer must press down pedal.

Pen.—A little. *Piano, or P.* Soft.

Pianissimo, or *PP*.—Very soft. *Plus*.—More.

Poco a poco.—Gradually; by a regular gradation.

Pomposo.—Pompously. *Precipitato*.—Very quickly; hurriedly.

Premiere.—First; as *Première fois*; first time.

Presto.—Very quick. *Primo*.—As *Violino primo*, first violin.

Quasi.—In the manner of; like. *Quieto*.—With repose, quietly.

Rapido.—Rapidly. *Rinforzando*.—*Rinf.* or *Rf.* with increase.

Ritenente, *Ritenato*.—Decreasing in speed.

Segno.—Sign, as *al segno*, go back to sign.

Sempre.—Always, as *Sempre piano*. *Serioso*.—Seriously.

Solo, *Sola*.—Alone. A composition rendered by one person.

Sostenuto or *Sost.*—Prolonged, sustained.

Spirito.—With spirit.

Staccato.—Each note to be distinctly marked.

Stesso.—The same.

Syncopation.—Connecting the last note of a bar with the first note of the following, thus forming one prolonged note with a duration equal to the two.

Syncopate.—In a syncopated style. *Tanto* or *Ton.*—Not so much.

Tardo.—Slowly. *Tempo Comodo*.—Conveniently.

Theme.—A subject. *Tranquillo*.—Tranquilly.

Tremendi.—With terrific expression.

Tremando, *Tremolo*.—The rapid striking of a note so as to produce a tremulous effect.

Trille or *Trillo*.—A trill or shake.

Trio.—A composition for three performers.

Triplet.—A group of three notes equal in duration of time to two notes of the same value.

Un A.—As *un poco*, a little.

Veloce.—Rapidly.

Velocissimo.—With great rapidity.

Vigorouso.—With vigor.

Vivace.—Vivamented; briskly.

Volti Subito.—Turn over quickly.

Dreams.—Macknish describes dreams to be “the resuscitation or re-embodiment of thoughts which have formerly, in some shape or other, occupied the mind. They are old ideas revived, either in an entire state, or heterogeneously mingled together. I doubt if it be possible,” he continues, “for a person to have in a dream any idea whose elements did not, in some form, strike him at a previous period. If these break loose from their connecting chains, and become jumbled together incoherently, as is often the case, they give rise to absurd combinations; but the elements still subsist, and only manifest themselves in a new and connected shape.”

Tertullian describes dreaming as the refreshment of the soul. He rejects the doctrine of Epicurus in which dreams are disparaged as idle and fortuitous, maintaining that they are agreeable to the course and order of nature. Vain, frivolous, impure and turbulent dreams he attributes to demons, while those that are pure and pleasant proceed from God or his angels. Lactantius expresses his conviction of divine agency of dreams. St. Cyprian states that he was divinely instructed in a dream to mix a little water with the wine for the Holy Eucharist. St. Bernard was a firm believer in dreams, which he treats of at great length in his remarkable sermon “On

Sleep." St. Thomas Aquinas affirms faith in dreams, but maintained that only those which are suggested by angels may be investigated and interpreted, those inspired by demons and evil spirits being left alone.

A recent author expresses a strong and fixed faith in the divine inspiration of dreams, and adduces many powerful instances from sacred and profane history to prove that the will of Omnipotence is often executed through the medium of visions. The wonderful examples related by Scriptural writers are liberally drawn upon. The case of King Abimelech, warned against taking Abraham's wife (whom he had untruly called his sister), is cited as an early instance, as are the warnings and directions given by God to Jacob and Laban; also, the dreams and visions of Daniel, and of Joseph, both with regard to the Blessed Virgin and the malice of Herod; the warning dreams of the three Eastern Kings, and that of Pilate's wife, all of which are familiar to Bible readers.

Legal Holidays Throughout the United States.—*January 1st, or New Year's Day*, is a legal holiday in all the States except Arkansas, Delaware, Georgia, Kentucky, Maine, Massachusetts, New Hampshire, Rhode Island and North and South Carolina.

February 22d, or Washington's Birthday, is a legal holiday in all the States but Alabama, Arkansas, Florida, Illinois, Indiana, Iowa, Kansas, Maine, Missouri, North Carolina, Ohio, Oregon, Tennessee and Texas.

May 30th, or Decoration Day, is a legal holiday only in Colorado, Connecticut, Maine, Michigan, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont.

January 8th, the Anniversary of the Battle of New Orleans; *February 12th*, the anniversary of the birth of Abraham Lincoln; and *March 4th*, the Firemen's Anniversary, are legal holidays in Louisiana.

July 4th, or Independence Day, is a legal holiday in all the States and Territories.

December 25th, Christmas Day, is a legal holiday in all the States and Territories.

Thanksgiving Day and Public Fast Days, appointed by the President of the United States, are legal holidays. Such days are legal holidays in such States as may set them apart for religious observance by proclamation of the Governor.

Days appointed for general elections, State or National, are legal holidays in California, Maine, Missouri, New Jersey, New York, Oregon, South Carolina and Wisconsin.

Good Friday is a legal holiday in Florida, Louisiana, Minnesota and Pennsylvania.

Shrove Tuesday is a legal holiday in Louisiana and in the cities of Mobile, Montgomery and Selma, Alabama.

Memorial Day (April 26th) is a legal holiday in Georgia.

March 2d, the anniversary of the independence of Texas, and *April 21st*, the anniversary of the battle of San Jacinto, are legal holidays in Texas.

Freezing Points, Etc., of Various Substances.—Mercury freezes at 40° below zero, and melts at 39°. Ether freezes at 47° below zero; wine freezes at 20°; sea water freezes at 28.3°. Alcohol has been exposed to 110° and 120° below zero without freezing. Granite decomposes at a red heat. The second's pendulum, of 39.139 ins., is lengthened by 30° of temperature 128th of an inch, or 8 vibrations in 24 hours.

The heat conducting powers of metals, etc., are as follows: Gold, 1,000°; platinum, 981°; silver, 973°; copper, 898.2°; iron, 374.3°; zinc, 363°; tin, 303.9°; lead, 179.6°; marble, 23.6°; porcelain, 12.2°; fine clay, 11.4°.

1 lb. of coke melts 94 lbs. of ice; 1 lb. of coal, 90 lbs.; 1 lb. of wood, 52 lbs.; 1 lb. of charcoal, 95 lbs.; 1 lb. of peat, 19 lbs. The capacity of the solar heat all over the globe is the ability to melt an icy covering 46 feet in thickness.

Animal Wonders.—In each grain of sand there are marvels; in every drop of water a world. In that great spectacle called Nature, every being has its marked place and distinct role; and in that great drama called life, there presides a law as harmonious as that which rules the movement of the stars. Each hour removes by death myriads of existences, and each hour produces legions of new lives. The highest as well as the lowest organism consumes carbon and water to support life and its duties, and it is not uninteresting to glance at the food, the habits, and the ways and means, peculiar to some of the inferior animals. From the petrified ejections we know what such fossilized reptiles as the plesiosaurus, etc., are, and may some day be able to discover the fish and crustacea they hunted down.

Animals, when not living by their own respectable efforts, are either parasites or dependents; many would seem to have positive trades, or are connected with branches of industry. There are miners, masons, carpenters, paper manufacturers, and weavers, lace-makers even, all working first for themselves, and next to propagate their kind. The miners dig into the earth, form natural arches and supports, remove the useless soil; such as the mole, the chinchilla of Peru, the badger, the lion ant, as well as certain worms and mollusks. The masons build huts and places according to all the rules of architecture, as the bees and tropical ants; there are fish that construct boats that the waves never can upset, and Agassiz has drawn attention to a fish which builds its nest on the floating sea-weed in the middle of the ocean, and deposits therein its eggs. The wasps of South America fabricate a sort of paper or pasteboard. Spiders are weavers as well as lace-makers; one species constructs a diving-bell, a palace of lace. When the astronomer has need of the most delicate thread for his telescope, he applies to a tiny spider. When the naturalist desires to test his microscope, he selects a certain shell of a sea insect, so small that several millions of them in water could not be visible to the naked eye, and yet no microscope has yet been made sufficiently powerful to reveal the beautiful variegated designs on the atomic shell. Aristotle remarked, and he has since been corroborated, that a variety of plover enters the crocodile's mouth, picks the remnants of food off the animal's tongue and from between its teeth. This living toothpick is necessary, as the tongue of the crocodile is not mobile. The Mexican owl, when enjoying a siesta, puts itself under the guard of a kind of rat, that gives the alarm on the approach of danger. Parasites are everywhere, dependent on no peculiar condition of the body, and are as abundant in persons of the most robust as of the most debilitated health. They are at home in the muscles, in the heart, in the ventricles of the brain, in the ball of the eye. They are generally either in the form of a leaf or a ribbon, and are not necessarily, as was once supposed, confined to a special animal. The parasites of fish have been detected living in the intestines of birds; and there are some that, for the purpose of development, must pass into the economy of a second animal.

Ancient Clocks and Watches.—In early times watches were often made in the forms of skulls and coffins, suggested, doubtless, by the solemnity of the flight of time.

A death-head watch, which formerly belonged to Mary Queen of Scots, and was bequeathed by her to her maid of honor, Mary Setore, on February 7, 1587, and afterwards came into possession of Sir John Dick Lander, is of silver gilt, and is most elaborately ornamented. The forehead of the skull bears the symbols of death, the scythe and hour-glass placed between a palace and a cottage to show the impartiality of the grim destroyer. At the back of the skull is Time destroying all things, and at the top of the head are scenes of the Garden of Eden and the crucifixion. The watch is opened by reversing the skull, placing the upper part of it in the hollow of the hand and lifting the jaw by the hinge, this part being enriched by engraved representations of the Holy Trinity, angels, and shepherds with their flocks. The works of the watch form the brains of the skull, and are within a silver envelope which acts as a musically-toned bell, while the dial-plate is in the place of the palate. This curious work of art, which was made at Blois, is too large to be carried as a pocket watch. Another skull watch, which once belonged to Mary Queen of Scots, by its inscription and the date, 1560, shows that Francis II, of France, presented it to his young wife many years before watches were supposed to have been brought to England from Germany. Several other of Queen Mary's watches are described. One in a case of crystal, shaped like a coffin, and another made at Rouen, in which a thread of cat-gut supplied the place of the chain used in the work of modern watches. Early watches were sometimes so small as to be set in the head of walking sticks, the clasp of bracelets, in rings, or in pendants, and we read of a striking watch mounted in a ring, in the year 1542. At the Strawberry Hill sale Queen Victoria purchased a little clock of brass-gilt which had been presented to Anne Boleyn by Henry VIII upon their marriage in 1532, for £110 5s. It is now at Windsor Castle, and in going order. It is richly chased and engraved.

The clock placed in one of the towers at the palace at Hampton Court, in 1551, is described as the oldest English made clock extant. When in action it showed the motions of several of the planets. The dial and several of the wheels attached to the back of the dial still remain.

A Marvelous Stream.—At a distance of thirty miles south of the river Diamante our route passed through a natural object of considerable interest—a stream, or rather rill, of yellowish white fluid, like petroleum, issuing from the mountain side at a considerable height, and trickling down the slope till lost in the porous soil of the valley below. The source from which it flowed was at the junction where a hard, metamorphic rock, interspersed with small crystals of agnite, overlay a stratum of volcanic stuff. It was formed like the crater of a volcano, and full of black, bituminous matter, hot and sticky, which could be stirred up to the depth of eighteen inches. Floundering in it was a polecat or skunk (*Memphitis varians*), having been enticed to its fate by the desire of securing a bird caught in the natural birdlime, till a bullet from the revolver of one of the party terminated the skunk's struggles to extricate itself from the warm and adhesive bath in which it was hopelessly held captive. The overflow from this fountain was, as described, like a stream of petroleum two or three feet wide trickling over a bed of pitch or some such substance, which extended to a much greater width along the edge of the running stream at its contact

with it. This material was of a very sticky nature, becoming gradually harder as it spread farther out, assuming the appearance of asphalt when it became mingled with the loose sand of the adjoining soil.

While engaged in examining this natural curiosity, we came upon two small birds caught in the sticky substance at the edge of the stream. They were still alive, but upon releasing them both the feathers and the skin came off where they had come in contact with the bituminous matter, so that we had to kill them to put an end to their sufferings. No doubt they had been taken in by the appearance of water which the stream presented, and had alighted to drink. Their fate suggested the idea that in a district so devoid of water others of the feathered tribes must constantly become victims to the same delusion in a similar manner, and upon a close inspection of the margin of the stream the correctness of this inference was established by the discovery of numerous skeletons of the birds embedded in it; nor were those of small quadrupeds unrepresented, among which we recognized the remains of a fox.

Whale Fishing.—The immense bulk and energies of the whale itself do not constitute the least formidable among the terrors of this field of adventure. The desolate and inclement region, which is the scene of enterprise, encompasses the pursuit with its worst hardships and dangers. In this realm of eternal Winter, man finds the land, the sea and the air, equally inhospitable. Everything fights against him. The intensest cold benumbs his flesh and joints; while fogs or driving sleet often darken the sky, and at the same time arm the frost with a keener tooth. The ocean over which he moves, besides its ordinary perils, is crowded with new and strange horrors.

Sometimes the ice lies in fixed beds that bar all navigation as effectually as would a wall of iron, and over whose rugged and broken surface he can only make his way by leaping from point to point, at the risk of being engulfed at every step. Sometimes it bears down upon him in vast floating fields with such an impetus that, at the shock, the strong timbers of his ship crack and give way like an egg-shell, or are crushed and ground to fragments between two meeting masses. Sometimes it rises before him in the shape of a lofty mountain which the least change in the relative weights of the portion above and that beneath the surface of the water may bring in sudden ruin upon his head, burying crew and vessel beneath the tumbling chaos, or striking them far into the abyss.

As for what may be dimly distinguished to be land, rimming with its precipitous coasts these dreary waters, it may be most fitly described in the lines in which the poet has pictured one of the regions of the nether world:

“Beyond this flood a frozen continent
Lies dark and wild, beat with perpetual storms
Of whirlwind and dire hail, which on firm land
Thaws not, but gathers heap, and ruin seems
Of ancient pile; or else deep snow and ice.”

At the farthest limit to which adventure has pierced, a night of four months' duration closes each dismal year, throughout which human life has indeed been sustained by individuals previously inured to a severe climate, but the horrors of which have, in most of the instances in which the dreadful experiment has been either voluntarily or involuntarily tried by the natives of more temperate regions, only driven the wretched sufferer through a succession of the intensest bodily and mental tortures and then laid them at rest in the sleep of death.

The Worries of Authorship.—There are many disappointments in life, and among the saddest is that of the author who finds no market for the products of his brain. This misfortune has befallen the brightest of intellects. The coinage of their brains, stamped with genius, has found no currency during the author's generation.

"Paradise Lost" brought John Milton only a paltry five pounds—about twenty-five dollars of our money.

Wordsworth once told Matthew Arnold that for many years "his poetry had never brought him in enough to buy his shoestrings."

"Uncle Tom's Cabin," which has a world-wide fame, and has been translated into many languages, went begging from publisher to publisher, before one recognized its great merit.

Hawthorne for twenty years continued to be, to use his own words, "the obscurest man of letters in America." "There is not much market for my wares," he said at another time. But he ranks to-day among the American classics.

Thoreau was another example. A thousand copies of his "A week on the Concord and Merrimac Rivers" were struck off by his publisher. After a year or so, the author received word that his work would not sell, and that seven hundred and six copies were occupying cellar-room wanted for other use. Accordingly, they were transported from Boston to Concord. The work had gone forth in its nakedness and now returned in fine clothing of calico and leather, back to the old homestead, as so many poor unfortunates who have failed in the struggle of life have done. Thoreau gave them kindly though sorrowful welcome. He laid them on his back and carried them "up two flights of stairs to a place similar to that which they traced their origin." With a sort of grim humor he said, "I have now a library of nearly nine hundred volumes, over seven hundred of which I wrote myself."

Fire and Matches.—Who first made fire, when and where, a little child can easily ask, but a wise man cannot answer. The Persians, Phœnicians, Greeks, and other nations assert that their ancestors were without fire. Pliny says the ancient Egyptians were greatly delighted with fire, which was exhibited by Exedus, the celebrated astronomer. Until recently the inhabitants of the Philippine, Canary, and many other islands had never seen a fire. The inhabitants of the Marian Islands at first believed fire an animal that fed on wood. Fire and heat are both obtained by friction. Probably man first obtained fire by rubbing two pieces of wood together. Formerly a common practice among the people of the Sandwich Islands was to place a block of very dry wood on the ground and rub it with a blunt stick back and forth till a groove was made and ultimately fire. Captain Cook states that the Australian takes a dry piece of soft wood, which is partially sharpened at one end, and resting the point upon a block, revolves the stick rapidly between the hands, and often gets fire in two minutes. The natives of Terra del Fuego, "Land of Fire," made fire by striking flint with iron pyrites, the sparks being caught on tinder. Our forefathers made use of similar means. Centuries ago glass globes filled with water were used to concentrate the rays of the sun and produce fire. Over two hundred years ago it was discovered that phosphorus, by friction, would ignite dry sticks dipped in sulphur. In 1836, Mr. A. D. Phillips, of Springfield, Mass., patented a mixture of glue, phosphorus, chalk and sulphur, with which friction matches were made, and soon they came into general use. Now seventy-five factories give work to twenty-five hundred employees,

one-third of whom are children. Annually 30,240,000,000 matches are made.

Traveling Stones.—Many have doubtless heard of the famous traveling stones of Australia. Similar curiosities have recently been found in Nevada, which are described as almost perfectly round, the majority of them as large as a walnut, and of an iron nature. When distributed about upon the floor, table, or other level surface, within two or three feet of each other, they immediately begin traveling toward a common center, and there lie huddled up in a bunch like a lot of eggs in a nest. A single stone, removed to a distance of three and a half feet, upon being released, at once started off, with wonderful and somewhat comical celerity, to join its fellows; taken away four or five feet, it remained motionless. They are found in a region that is comparatively level, and is nothing but bare rock. Scattered over this barren region are little basins from a few feet to a rod or two in diameter, and it is in the bottom of those that the rolling stones are found. They are from the size of a pea to five or six inches in diameter. The cause of these stones rolling together is, doubtless, to be found in the material of which they are composed, which appears to be lodestone or magnetic iron ore.

A Valley of Death.—A valley surpassing in reality of horrors the fabled region of the upas tree is reported to have been discovered in the island of Java. This island is volcanic, and in one spot the emanations from the interior of the earth are so deadly that the place is called the Valley of Death. As the traveler approaches it he is attacked by nausea and giddiness. He also notices a suffocating smell. As he advances these symptoms disappear, so that, after passing through the belt of fetid air which guards the valley, the visitor is able to examine with less risk the spectacle before him. A recent traveler describes the valley as being an oval, about one mile in circumference, and from thirty to forty feet below the level of the surrounding land. The floor of the valley is flat, dry, without any vegetation; and scattered all over it are the skeletons of men, tigers, wild boars, birds, and stags, lying among large blocks of stone. No steam or smoke is to be seen, nor is any crevice apparent in the earth, which appears to be as hard as a rock. The hills which hem in this valley of desolation are clothed from base to summit with healthy trees and bushes. The traveler from whom we have already quoted descended the side of one hill, with the aid of a bamboo stick, to about eighteen feet from the bottom, and he compelled a dog to go down to the plain. In five seconds the animal fell on its side motionless, although it continued to breathe for eighteen minutes. Another dog died in ten minutes; and a fowl only resisted the deadly air for a minute and a half, and was dead before he reached the bottom. It is believed that the human skeletons are those of malefactors who have sought refuge here, ignorant of the fatal influence of the air they came to breathe. The neighboring mountains are volcanic, but they neither emit sulphurous odors, nor do they present any indications of recent eruption.

A Wonderful Cave.—Kent's cavern, in the vicinity of Torquay, in Devonshire, England, is a remarkable cave, consisting of a great excavation in the Devonian limestone. It is entered by a narrow passage some seven feet wide and only five feet in height. The central cavern, which is almost 200 feet long, has a number of smaller caverns or corridors leading out from it. Its farthest extremity is terminated by a deep pool of water. In

the bed of this cavern modern research has been rewarded by some deeply interesting discoveries. Over the original earth bottom of the cave is a bed or layer of considerable thickness, in which are contained strange mixtures of human bones, with the bones of the elephant and the rhinoceros, the hyena, the bear, and the wolf, intermingled with stone and flint tools, arrow and spear heads, and fragments of coarse pottery. The animal remains testify to the presence in the ancient forests of Britain of beasts of prey which long since have become extinct. Speculation may be exhausted in the endeavor to account for the curious intermingling in this cavern of the remains of human beings and of wild animals. The place may have been used for shelter successively by man and by the lords of the forest; or, as the presence of the rude weapons of man might seem to indicate, the beasts of the field may have been brought into this natural recess as trophies of the chase, and their flesh and skins used for purposes of food and clothing. Nothing less than the most persevering and enthusiastic search could have discovered the interesting remains which, for a vast period of time, had been buried in this retreat, for the fossils were covered by a thick floor of stalagmite which had been formed by great blocks of limestone, which had fallen from time to time from the roof of the cavern, and had become cemented into one mass by the perpetual percolations of limewater from above.

The Richest Women in New York.--It seems that the richest women in New York are Mrs. John Jacob Astor, who has a fortune of \$8,000,000; Mrs. William Astor, worth \$6,000,000; Mrs. Josephine Ayer, worth \$4,000,000; Mrs. Isaac Bell, Jr., worth \$2,000,000; Miss Linda Blatchford, worth \$2,000,000; Mrs. James Brown, worth \$4,000,000; Mrs. Franklin Delano, \$2,500,000; Mrs. William E. Dodge, Sr., \$4,000,000; Mrs. Coleman Drayton, who has an income of \$100,000 a year; Mrs. Robert Goelet, \$3,000,000; Miss Sarah Hitchcock, \$12,000,000; Mrs. Mason-Jones, \$6,000,000; Mrs. Bradley Martin has \$1,000 a day; Mrs. John Minturn, \$2,000,000; Mrs. Charles Morgan, \$3,000,000; Mrs. E. W. Morgan has a life income from several millions; Mrs. Marshall O. Roberts, \$10,000,000; Mrs. Archibald Rogers, \$3,000,000; Mrs. Edwin H. Stevens, \$20,000,000; Mrs. Paran Stevens, \$6,000,000; Mrs. A. T. Stewart, \$30,000,000; Mrs. Moses Taylor, who has a life interest in an immense fortune; Mrs. Catherine Wolfe has an annual income of nearly \$500,000; Mrs. Abram S. Hewitt is worth \$2,000,000; Mrs. Jesse Hoyt, \$6,000,000; Mrs. George Merritt, \$2,000,000; Mrs. Frederick Neilson has \$80,000 a year; Mrs. George Osgood, \$2,500,000; Mrs. Percy R. Pyne has an income of \$535,000 a year; Mrs. Henry Remsen has a fortune of \$3,000,000; Mrs. C. Vanderbilt, \$1,500,000, and Miss George Quintard, \$6,000,000. These are lucky women, although there are many more whose incomes range from \$30,000 to \$75,000 a year.

The Discovery of Silk and Satin.--The discovery of silk is attributed to one of the wives of the emperor of China, Hoang-ti, who reigned about two thousand years before the Christian era; and since that time a special spot has been allotted in gardens of the Chinese royal palace to the cultivation of the mulberry tree and to the keeping of silk-worms. Persian monks who came to Constantinople revealed to the Emperor Justinian the secret of the production of silk, and gave him some silk-worms. From Greece the art passed into Italy at the end of the thirteenth century. When the popes left Rome to settle at Avignon, France, they introduced

into that country the secret which had been kept by the Italians, and Louis XI established at Tours a manufactory of silk fabrics. Francis I founded the Lyons silk works, which to this day have kept the first rank. Henry II of France wore at the wedding of his sister the first pair of silk hose ever made. The word "satin," which in the original was applied to all silk stuffs in general, has since the last century been used to designate only tissues which present a lusted surface. The discovery of this particular brilliant stuff was accidental. Octavio Mai, a silk weaver, finding business very dull, and not knowing what to invent to give a new impulse to the trade, was one day pacing to and fro before his loom. Every time he passed the machine, with no definite object in view, he pulled little threads from the warp and put them to his mouth, which soon after he spat out. Later on he found the little ball of silk on the floor of his workshop, and attracted by the brilliant appearance of the threads, he repeated the experiment, and by using certain mucilaginous preparations, succeeded in giving satin to the world.

Ancient Babylon.—Between 2,000 and 500 B. C., Babylonia was the garden of the ancient world. The land, surrounded like an island by two of the finest streams in the world, the Euphrates and Tigris—the rivers of Paradise—is truly the gift of both. They flowed with swift current from the Armenian highlands into the sea now known as the Persian Gulf. In the course of centuries large masses of loam were rolled down and heaped at their original mouths, and this is what we now call Babylonia. It was on this soaked, fat and fertile soil that the oldest authentic civilization, not of Asia merely, but of the world, developed itself. The melting of the Armenian snows caused inundations which had to be checked by damming the rivers with dykes and walls. Canals served for navigation, and also led off the superfluous waters to parts unaffected by the overflow, and developed to such a degree their fertility that wheat and barley often gave the laborer two or three hundred fold. Near Bagdad the two rivers are so near that only six hours are required to pass from one to the other. On this tongue of land, which was once a fourth narrower, the great canal system commenced, and by means of still smaller arteries, the life-giving waters were distributed to nearly every tree. The district between Bagdad and Hilla (a three-days' ride), was formerly strewed with heaps of towns and villages. To its south, in the very heart of the land, lay Babylon, "the gate of God." Its commercial importance is described, its fortifications, the Euphrates (half a mile wide), swarming with ships of every size, the large Euphrates bridge, built by Nebuchadnezzar, the different quarters and great buildings, the royal bank, where important business, public and private was transacted.

Why a Man Cannot Fly.—No combination of wings will enable a man to fly until he can wield them with as much muscular power to the pound of weight as a bird exerts in flying. If a man had in his legs the muscular energy and leverage of a flea, he could jump a mile in three leaps, and if his arms had in proportion to his weight the driving power of a wild pigeon's wing, he would have no use for railways or balloons. The transportation problem would be solved. Moving himself so easily and so swiftly, he would not need to move anything else. The albatross, weighing twenty-eight pounds, can keep its wings, thirteen feet from tip to tip, in motion all day, while the strongest man, weighing six or eight times as

much, would exhaust all his strength in keeping even an albatross's wings in motion half an hour. "We have in the bird," says the *Engineer*, "a machine burning concentrated fuel in a large grate at a tremendous rate, and developing a very large power in a small space. There is no engine in existence, certainly no steam engine and boiler combined which, weight for weight, gives out anything like the mechanical power exhibited by the albatross. Consequently, no machinery yet devised can operate wings with sufficient power to sustain its own weight in the air, and there is no known machinery by which a man can wield the force necessary to fly like a bird. Keely's alleged discovery, or some new process of storing and exerting great electric power in apparatus of light weight, might supply the deficiency, but science has not learned how to develop in inanimate machinery anything like the mighty nervous energy which acts in the bones, sinews, and muscles of a living bird's wing."

A River of Hot Water.—The great Sutro Tunnel, cut to relieve the celebrated Comstock mines at Virginia City, Nevada, of the vast quantities of hot water which are encountered in them, affords an outlet to twelve million tons every twenty-four hours, or about three billion gallons. Some of the water, as it finds its way into the mines, has a temperature of 195° , while four miles from the mouth of the tunnel the temperature ranges from 130° to 135° . To obviate the inconvenience which would arise from the vapor such a vast quantity of water would give off, the flow is conducted through the entire tunnel, four miles, in a light flume of pine. At the point of exit the water has lost but seven degrees of heat. Sixty feet below the mouth of the tunnel the hot water is utilized for turning machinery belonging to the company, from whence it is carried off by a tunnel eleven hundred feet in length, which serves as a waterway. Leaving the wasteway tunnel, the water flows to the Carson River, a mile and a half distant. This hot water is being utilized for many purposes. The boys have arranged several pools where they indulge in hot baths. The miners and others use it for laundry purposes, and arrangements are being made whereby a thousand acres belonging to the company are being irrigated. It is proposed to conduct the hot water through iron pipes, beneath the surface of the soil, near the roots of thousands of fruit trees which are to be planted, and in a similar manner give the necessary warmth to a number of hot-houses to be used for the propagation of early fruits and vegetables.

Australian Vastness.—It is not easy to grasp the enormous bulk of the Australian continent—the practically unlimited space within which the colonies have room to grow. The colony of Victoria—the smallest and at the same time the most populous and highly developed of the continental group—is about as large as Great Britain. New South Wales has an area five times that of England, but is not half so big as Queensland and only a third of the size of South Australia. Western Australia is even larger and more empty of population; after measuring acres with South Australia it would have almost sufficient land to furnish out New Zealand and Tasmania, and yet New Zealand compares in area with the British Islands, and Tasmania is nearly as large as Scotland. The acreage under crop in the Australian colonies in 1880 was 6,500,000 acres. That seems a respectable total; yet it seems ridiculously small when we compare with it the illimitable extent of land yet lying waste. To take the case of New South Wales, while there are 635,900 acres in cultivation and 17,500,000 acres inclosed

there are 180,000,000 acres, much of it excellent land, still unalienated. Even at the present rapid rate at which the land is being fenced, it will occupy 180 years to dispose of it all. This colony alone contained the extraordinary number of 32,400,000 sheep in 1880, besides 2,580,000 cattle and nearly 400,000 horses. Before the close of the next decade it is expected that the sheep stock of New South Wales will run to between 40,000,000 and 50,000,000 head.

Iowa's Great Wonder.—The greatest wonder in the State of Iowa, and perhaps any other State, is what is called the "Walled Lake," in Wright County, twelve miles north of the Dubuque and Pacific Railway, and one hundred and fifty miles west of Dubuque City. The lake is from two to three feet higher than the earth's surface. In some places the wall is ten feet high, fifteen feet wide at the bottom, and five wide on top. Another fact is the size of the stones used in construction, the whole of them varying in weight from three tons down to a hundred pounds. There is an abundance of stones in Wright County, but surrounding the lake to the extent of five or ten miles there are none. No one can form an idea as to the means employed to bring them to the spot, or who constructed it. Around the entire lake is a belt of woodland half a mile in width, composed of oak. With this exception the country is a rolling prairie. The trees must have been planted there at the time of the building of the wall. In the spring of the year 1856 there was a great storm and the ice on the lake broke the wall in several places, and the farmers in the vicinity were obliged to repair the damages to prevent inundation. The lake occupies a grand surface of two thousand eight hundred acres; depths of water as great as twenty-five feet. The water is clear and cold, soil sandy and loamy. It is singular that no one has been able to ascertain where the water comes from nor where it goes, yet it is always clear and fresh.

Invention of Balloons.—The admirers of crinoline will be proud to learn that the invention of balloons is owing to a similar contrivance. The French give a curious anecdote of a simple occurrence which led the inventor of such machines—Montgolfier—to turn his attention to the subject. It is to this effect: A washerwoman of the Rue aux Juifs, in the Marais, placed a petticoat on a basket-work frame, over a stove, to dry. In order to concentrate all the heat, and to prevent its escaping by the aperture at the top, she drew the strings closely together which are used to tie it round the waist. By degrees the stuff dried, became lighter, and the stove continuing to heat and rarefy the air concentrated under the framework, the petticoat began to move, and at last rose in the air. The washerwoman was so astonished that she ran out to call her neighbors; and they, seeing it suspended in the air, were amazed. One individual, however, a simple paper maker from Annonay, named Montgolfier, as much astonished but more sensible than the others, returned home, and without loss of time studied the work of Priestly on different kinds of atmosphere. The result was the discovery of the first balloon, called Montgolfier's, of which he was the inventor. As the Nautilus probably gave the idea of a sailing vessel, so also do very simple causes often produce great and unexpected results.

A Wonderful Clock.—A new perpetual clock was put up recently at the Gare du Nord, Brussels, in such a position as to be fully exposed to the influences of the wind and weather, and though it has not since been touched, it has continued to keep good time. The weight is constantly

wound up by a fan placed in the chimney. As soon as it approaches the extreme height of its course, it actuates a brake, which stops the fan; and the greater the tendency of the fan to revolve, so much the more strongly does the brake act to prevent it. A simple pawl arrangement prevents a down draft from exerting any effect. There is no necessity for a fire, as the natural draft of the chimney or pipe is sufficient; and if the clock is placed out-of-doors all that is required is to place it above a pipe sixteen or twenty feet high. The clock is made to run twenty-four hours after being wound up, so as to provide for any temporary stoppage, but, by the addition of a wheel or two, it may be made to go for eight days after cessation of winding. The inventor, a native of Belgium, showed his original model at the Paris Exhibition in 1878, but he has since considerably improved upon it.

The Gulf Stream.—There is a river in the ocean. In the severest droughts it never fails, and in the mightiest flood it never overflows. Its banks and the bottom are of cold water, while its current is of warm. The Gulf of Mexico is its fountain, and its mouth is in the Arctic Seas. It is the Gulf Stream. There is in the world no other so majestic a flow of water. Its current is more swift than the Mississippi or the Amazon, and its volume more than a thousand times greater. Its waters, as far as the Carolina coasts, are of indigo blue. These are so distinctly marked that the common sea water can be traced with the eye. Often one-half the vessel may be perceived floating in the Gulf Stream water, while the other half is in the common water of the sea, so sharp is the line and the want of affinity between these waters; and such, too, the reluctance, so to speak, on the part of those of the Gulf Stream to mingle with the common waters of the sea. In addition to this, there is another peculiar fact. The fisherman on the coast of Norway are supplied with wood from the tropics by the Gulf Stream. Think of the Arctic fishermen burning upon their hearths the palms of Hayti, the mahogany of Honduras, and the precious woods of the Amazon and the Orinoco!

Ancestry of the Pen.—The earliest mode of writing was on bricks, tiles, oyster-shells, stone, ivory, bark, and leaves of trees, and from the latter the term "leaves of a book" is probably derived. Copper and brass plates were very early in use; and a bill of feoffment on copper was some years since discovered in India, bearing date one hundred years before Christ. Leather was also used, as well as wooden tablets. Then the papyrus came into vogue, and about the eighth century the papyrus was superseded by parchment. Paper, however, is of great antiquity, especially among the Chinese; but the first paper-mill in England was built in 1588 by a German, at Dartford, in Kent. Nevertheless, it was nearly a century and a half—namely, in 1713—before Thomas Watkins, a stationer, brought paper making to anything like perfection. The first approach to a pen was the stylus, a kind of iron bodkin; but the Romans forbade its use on account of its frequent and even fatal use in quarrels, and then it was made of bone. Subsequently, reeds, pointed and split, like pens as in the present day, were used.

Limit of Perpetual Snow, and Growth of Trees.—On the Andes, in lat. 2 deg., the limit of perpetual snow is 14,760 ft. In Mexico, lat. 19 deg., the limit is 13,800 ft.; on the peak of Teneriffe, 11,454 ft.; on Mount Etna, 9,000 ft.; on Caucasus, 9,900 ft.; on the Pyrenees, 8,400 ft.; in

Lapland, 3,100 ft.; in Iceland, 2,890 ft. The walnut ceases to grow at an elevation of 3,600 ft.; the yellow pine at 6,200 ft.; the ash at 4,800 ft.; and the fir at 6,700 ft. The loftiest inhabited spot on the globe is the Port House of Ancomarca, on the Andes, in Peru, 16,000 feet above the level of the sea. The 14th peak of the Himalayas, in Asia, 28,178 feet high, is the loftiest mountain in the world.

How an Insect Breathes.—If we take any moderately large insect, say a wasp or a hornet, we can see, even with the naked eye, that a series of small, spot-like marks run along either side of the body. These apparent spots, which are generally eighteen or twenty in number, are, in fact, the apertures through which air is admitted into the system, and are generally formed in such a manner that no extraneous matter can by any possibility find entrance. Sometimes they are furnished with a pair of horny lips, which can be opened and closed at the will of the insect; in other cases they are densely fringed with stiff interlacing bristles, forming a filter, which allows air, and air alone, to pass. But the apparatus, of whatever character it may be, is always so wonderfully perfect in its action that it has been found impossible to inject the body of a dead insect with even so subtle a medium as spirits of wine, although the subject was first immersed in the fluid and then placed beneath the receiver of an air pump.

Alaska's Resources.—The resources of Alaska are abundant in quantity and magnificent in quality. They are divided between the sea and the land. The fisheries are described as being among the finest in the world. As many as 7,000 salmon are often taken at a single haul of the seine, some of them weighing from forty-five to 100 pounds each. Those captured at Crook's Inlet average even heavier, and distance all competition in Oregon or elsewhere. In the mining region near Sitka, ten well developed ledges of gold-bearing quartz have been uncovered, and eight mines are already located and will soon be in active operation. These ledges, which have been followed three miles or more, are pronounced, by a competent Russian engineer, capable of averaging \$32 per ton. Experienced miners who have examined them think the Alaska yield of gold and silver will eventually be larger than that of California and Nevada combined.

American Inventive Genius.—The inventions of man have had an immense influence in aiding the production of manufactured articles, and it has been estimated that two-thirds of the aggregate wealth of the United States is due to patented inventions. The patents granted by the United States Government are nearly equal to those of both the English and the French Governments combined.

A glance at one or two of our inventions will show us that the estimate mentioned above is not without some foundation. We make in this country annually about 1,000,000 sewing machines, which can do as much work as formerly required 12,000,000 women to do by hand. A single shoe factory in Massachusetts turns out as many boots as 30,000 bootmakers can in the city of Paris. It will take the raw leather and in twenty minutes turn out a pair of shoes ready for the wearer.

Fifty years ago all the spinning done in this country was done on a common household spinning-wheel. An active woman, working ten hours a day, could spin a thread 3 8-10 miles in length, and she would walk over five miles in doing it. Now, in one of our factories, you will see a girl of fifteen minding a machine which spins a thread 2,100 miles long in a day.

Before the cotton gin was invented, a man could only clean four pounds of cotton a day. Now he can clean 4,000 pounds a day with the help of the gin. The cotton crop of 1880, estimated at about 4,700,000 bales, under the old process of cleaning it, would require 505,000,000 days work, which at \$1 per day, would cost \$505,000,000 for cleaning the cotton. The work is now done by 1,614 men, at a cost of not over \$500,000.

In the production of Bessemer steel rails in this country, the value of patents in aiding production is quite as clearly seen. In 1868, the average price of steel rails was \$158 per ton. Now it is but \$34 per ton. In 1883 we produced 1,295,000 tons of steel rails. This quantity in 1868 would have cost nearly \$160,000,000 more than it would cost in 1884.

To take a broader view of the subject, we find that each operator in the United States turns out \$1,500 worth of goods per annum, while those of Great Britain produce only \$1,100 each; those of France about \$1,000; and those of Germany a little over \$500. Averaging all Europe, the operatives of the United States do double the value of work that the operatives of Europe do. This is the result of our inventive genius applied to our improved machinery.

Life Thoughts.—Your life is what you make it.

The best philosophy—a contented mind.

If you would be strong, conquer yourself.

Man should be ever better than he seems.

He dines sumptuously who dines out of debt.

No man can be free unless he governs himself.

Good company and good conversation are the very sinews of virtue.

The worst and most unendurable of all our ills are the imaginary ones.

Study books to know how things ought to be; study men to know how things are.

The sins of ignorance are most numerous, but the sins of knowledge are most dangerous.

Law is like prussic acid—a dangerous remedy, and the smallest dose is generally sufficient.

Our happiness does not consist in being without passions, but in having control of them.

You cannot dream yourself into a character; you must hammer and forge yourself into one.

The perfection of wisdom and the end of true philosophy is to proportion our wants to our possessions, and our ambitions to our capacities.

One reason why the world is not reformed is because every man is bent on reforming others, and never thinks of reforming himself.

The earth is a great factory wheel, which, at every revolution on its axis, receives fifty thousand raw souls, and turns off nearly the same number worked up more or less completely.

If we save the moments of time we will have enough for every needful work. Moments are the material of which days and years are made. If these be well improved, we will have years devoted to profitable employment.

A man who can give up dreaming and go to his daily realities, who can smother down his heart, its love or woe, and take to the hard work of his hand, who defies fate, and, if he must die, dies fighting to the last—that man is life's best hero.

We are ruined, not by what we really want, but by what we think we do;

therefore never go abroad in search of your wants. If they be real wants, they will come home in search of you; for he that buys what he does not want will soon want what he cannot buy.

The Number of Languages.—The least learned are aware that there are many languages in the world, but the actual number is probably beyond the dreams of ordinary people. The geographer Balbi enumerated eight hundred and sixty, which are entitled to be considered as distinct languages, and five thousand which may be regarded as dialects. Adulguns, another modern writer on this subject, reckons up three thousand and sixty-four languages and dialects, existing, and which have existed. Even after we have allowed either of these as the number of languages, we must acknowledge the existence of almost infinite minor diversities; for almost every province has a tongue more or less peculiar, and this we may well believe to be the case throughout the world at large. It is said there are little islands, lying close together in the South Sea, the inhabitants of which do not understand each other. Of the eight hundred and sixty distinct languages enumerated by Balbi, fifty-three belong to Europe, one hundred and fourteen to Africa, one hundred and twenty-three to Asia, four hundred and seventeen to America, one hundred and seventeen to Oceanica—by which term he distinguishes the vast number of islands stretching between Hindostan and South America.

Sounds During the Night.—The great audibility of sounds during the night is a phenomenon of considerable interest, and one which has been observed even by the ancients. In crowded cities, or in their vicinity, the effect was generally ascribed to the rest of animated beings, while in localities where such an explanation was inapplicable, it was supposed to arise from a favorable direction of the prevailing wind. Baron Humboldt was partially struck with this phenomenon when he first heard the rushing of the great cataract of the Orinoco in the plain which surrounds the mission of the Aures. These sounds he regarded as three times louder during the night than during the day.

Some authors ascribe this fact to the cessation of the humming of insects, the singing of birds, and the action of the wind on the leaves of the trees; but Baron Humboldt justly maintains that this cannot be the cause of it on the Orinoco, where the buzz of insects is much louder in the night than in the day, and where the breeze never rises till after sunset. Hence he was led to ascribe the phenomenon to the perfect transparency and uniform density of the air, which can exist only at night after the heat of the ground has been uniformly diffused through the atmosphere. When the rays of the sun have been beating on the ground during the day, currents of hot air of different temperatures, and consequently of different densities, are constantly ascending from the ground and mixing with the cold air above. The air thus ceases to be a uniform medium, and objects seen through it are very indistinctly visible with a tremulous motion, as if they were “dancing in the air.” The very same effect is perceived when we look at objects through spirits and water that are not perfectly mixed, or when we view distant objects over a red-hot poker, or over a flame. In all these cases the light suffers refraction in passing from a medium of one density into a medium of different density, and the reflected rays are constantly changing their direction, as the different currents rise in succession. Analogous effects are produced when sound passes through a mixed medium.

Inelegant Language.—Few people realize how many words are used improperly in the course of ordinary conversation. Take, for example, the word *fix*—the strict meaning of which is to make fast, to settle. But it is improperly used in many other ways, as “I fixed my hair, I fixed the wagon, I fixed my gloves, I fixed the room,” etc.; instead of “I brushed my hair, I repaired the wagon, I sewed my gloves, I put my room in order,” etc. Another word, used still more loosely and widely, is “*nice*.” This properly means over-exact, punctilious, delicate, subtle. But it is often employed to denote all commendable qualities. We often hear careless speakers say, “this apple is nice,” instead of delicious; “she is a nice girl,” instead of good or agreeable; “a nice landscape,” for a lovely landscape; “a nice cottage,” instead of a snug one; “a nice man,” instead of a genial man; “a nice mountain,” instead of a grand or lofty one; “a nice drink of water,” for a refreshing one; “a nice smell” to a flower, for a pleasant odor; and so on without limit. Then there is the word *awful*, meaning fearful or sublime. Yet, how frequently we hear of an awful nice day or an awful-looking dress! The word “*got*” is another victim which is dragged into service on all occasions. “I got up in the morning and got my breakfast, got to work soon after and got home by ten,” for example. All these inelegancies are unpleasant to the refined ear. To correct them, when they have become a habit, repeat to yourself the correction, and continue to repeat it till it becomes ready and familiar in use. In this way young persons may acquire the habit of using the best language, and the longer it is continued the easier it will become.

The Origin of Postage Stamps.—The origin of the postage stamp had a tinge of romance in it. It was thirty-seven years ago that Rowland Hill, while crossing a district in the north of England, arrived at the door of an inn where a postman had stopped to deliver a letter. A young girl came out to receive it; she turned it over and over in her hand and asked the price of postage. This was a large sum, and evidently the girl was poor, for the postmaster demanded a shilling. She sighed sadly and said the letter was from her brother, but that she had no money, and so she returned the letter to the postman. Touched with pity, Mr. Hill paid the postage and gave the letter to the girl, who seemed very much embarrassed. Scarcely had the postman turned his back, when the young inn-keeper's daughter confessed that it was a trick between her and her brother. Some signs on the envelope told her all she wanted to know, but the letter contained no writing. “We are both so poor,” she added, “that we invented this mode of corresponding without paying for the letters.” The traveler, continuing his road, asked himself if a system giving rise to such frauds was not a vicious one? Before sunset Rowland had planned to organize the postal service upon a new basis—with what success is known to the world.

A Paper-Making Spider.—In the heart of the African Continent, where no other paper is manufactured, the spider paper-maker does her quiet work. Back and forth, over a flat service about an inch and a half square, on the inside wall of a hut, the spider slowly moves in many lines until the square is covered with a pure white paper. Under this she places from forty to fifty eggs; and then, to fasten the square of paper more securely to the wall, she makes a strip of paper about a quarter of an inch broad, and with this glues the square carefully around the edges.

When all is done, the spider—which is quite a large one—places herself

on the center of the outside of the little flat bag so carefully made, and begins a watch, which is to last for three weeks without intermission. Apparently the young spiders would have many dangers to fear, did not their anxious mamma wage a fierce war upon the cockroaches and other insects that come near. After three weeks of unremitting watchfulness, the mother-spider leaves her nest in the day-time to hunt food, but she always returns at night, until her young are strong enough to take care of themselves.

Statistics of Longevity.—Dr. Farr, an English scientist, says that if one could watch the march of 1,000,000 people through life the following result would be observable: Nearly 150,000 will die the first year, 53,000 the second year, 28,000 in the third year, and less than 4,000 in the thirteenth year. At the end of forty-five years 500,000 will have died. At the end of sixty years 370,000 will be still living; at the end of eighty years, 97,000; at eighty-five years, 31,000, and at ninety-five years, 2,100. At the end of 100 years there will be 223, and at the end of 108 years there will be but one survivor.

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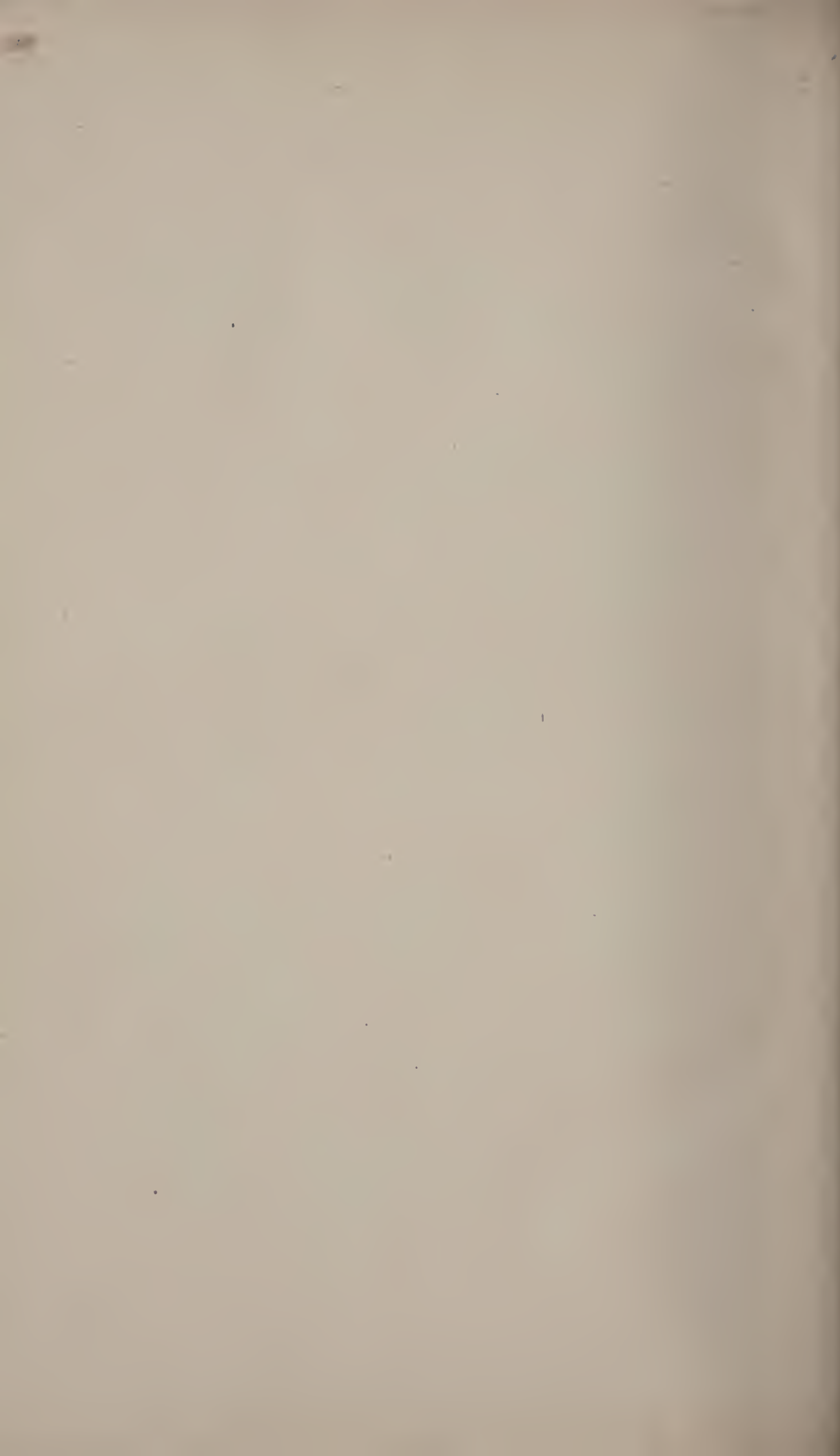
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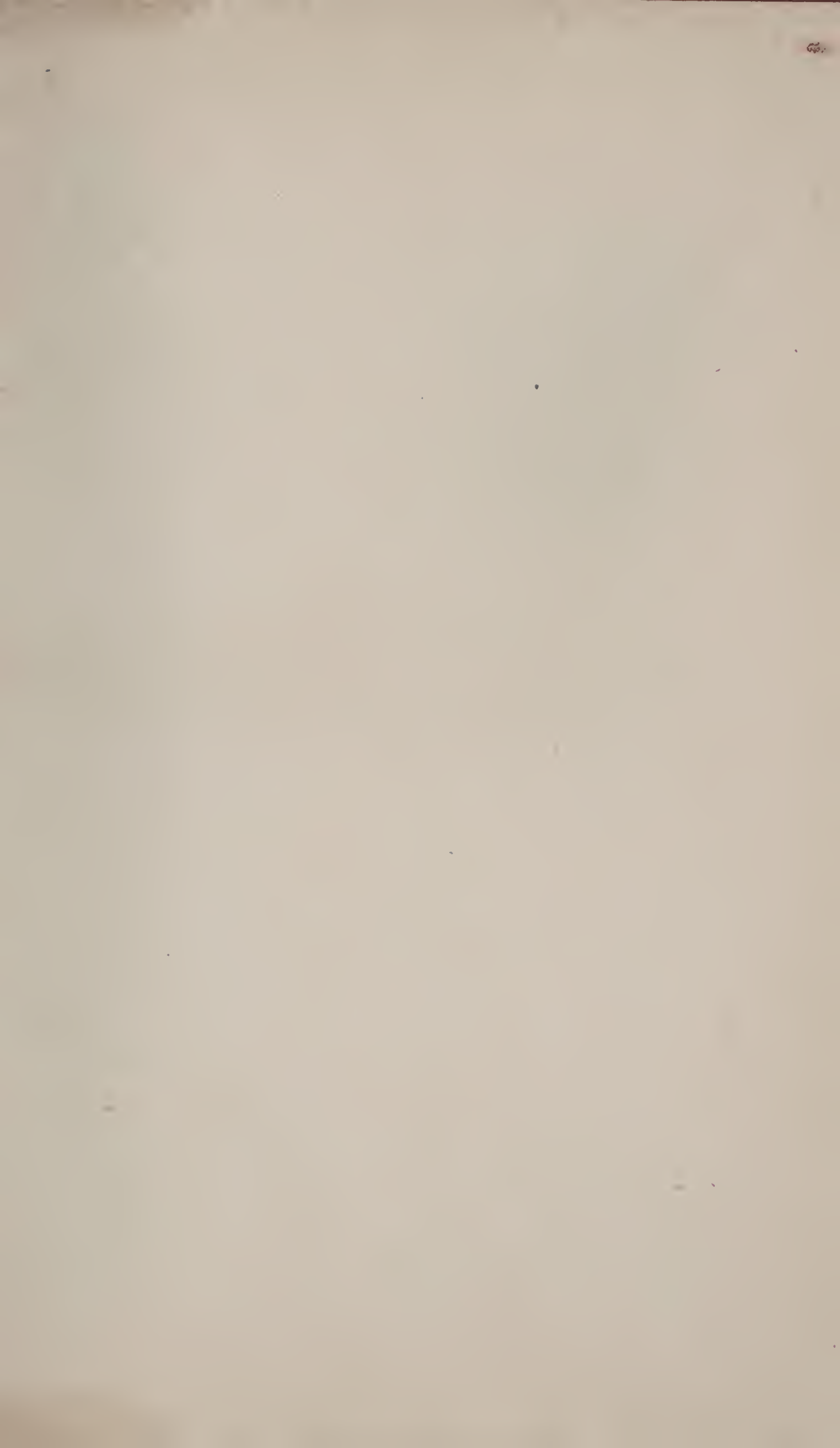
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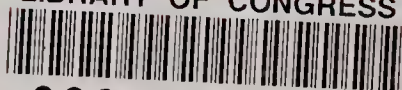
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